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WHY A PERIPHERAL TONE ANALYSIS IS NECESSARY TO EXPLAIN THE PHENOMENA OF TONE PERCEPTION.*

BY GEORGE E. SHAMBAUGH, M. D., CHICAGO.

At a previous meeting of this society, February 9, 1909, I discussed briefly the conclusions reached in my work on the physiology of the cochlea. I pointed out that the stimulation of the nerve endings of the acoustic nerve in the cochlea is undoubtedly brought about by an interaction between the projecting hairs of the hair cells, and the overhanging membrana tectoria. At this time I discussed some of the reasons for the conclusion that the membrana tectoria and not the membrana basilaris is the active agent which brings about this interaction by responding to the impulses of sound waves passing through the cochlea. I also explained at that time that our conclusions as to the probable mode of response which the membrana tectoria gives to the various tone impulses must be determined largely by ascertaining what mode of response will best explain the phenomena associated with tone perception, since the mechanism is too delicate and too complex to permit of physical demonstration. In this respect the ear is exactly like the other special sense organs. The final explanation of the mechanism of all the special sense organs is in the nature of an hypothesis that eludes actual demonstration. In discussing the probable action of the membrana tectoria, I pointed out that three possible modes of response suggest themselves. By the one the whole of the membrana tectoria would be thrown into motion by every tone, thus bringing about a stimulation of all the nerve endings in the cochlea for every tone. By the second mode the highest tones would throw into vibration the tiny

*Read before the Chicago Laryngological and Otological Society, April 13, 1909.

tectorial membrane near the beginning of the basal coil, while each succeding tone lower in the scale would cause to vibrate a larger and larger area of the tectorial membrane, until the lowest tones would throw this entire membrane into vibration. By the third mode of response different segments of the tectorial membrane would be thrown into vibration, each for a tone of a different pitch.

In my discussion at that time I made the statement that the first mode of response whereby the whole of the membrana tectoria would vibrate to the impulses of every tone, thus stimulating all the hair cells, was but a restatement of the telephone theory, an untenable hypothesis that had long since been discarded by physiologists. One of the members, in discussing my paper, took exception to my statement that the telephone theory was untenable, and asserted that he was an advocate of this theory, but gave no arguments supporting his position. When it was suggested that we devote part of the time of this meeting to a discussion of the telephone theory, I very willingly consented to present some of the arguments why the telephone theory is untenable, and why the opposite hypothesis, that of a peripheral analysis, is indispensable in accounting for the phenomena of tone perception. I must admit, however, in taking up this discussion, that I have felt a good deal as one would when asked to defend the theory that the earth revolves around the sun rather than that the sun makes revolutions about the earth. The real arguments appear to be all on the one side, yet to attempt to prove to another in a few minutes' discussion that the latter hypothesis is untenable, might not necessarily appear conclusive.

The most conspicuous phenomenon to be accounted for in connection with tone perception is that of subjective tone analysis. This is the faculty which the ear possesses of analyzing into its component elements complex tone impulses. There are two theories as to where this tone analysis is accomplished. According to one, it is accomplished by the peripheral apparatus in the cochlea. According to the other theory, this analysis is a function of the cerebral cortex. These two propositions may be stated graphically as follows: Supposing the tones, a, b and c, are sounded together, the complex impulse arising is analyzed subjectively, so that we are able to recognize the separate tones, a, b and c. According to the theory of peripheral analysis, when this complex, which we may designate by X, reaches the cochlea, it is analyzed so that separate groups of nerve fibers are stimulated for each of the three tones, a, b and c. When the three separate sets of nerve impulses arising in this way, which

we may designate by a^1, b^1 and c^1, reach the center in the cortex, they are perceived as the tones a, b and c.

According to the hyothesis of a central cortical analysis, all of the nerve endings in the cochlea are stimulated by the complex tone impulse X, thus causing the nerve trunk to act as a unit, the resulting nerve impulse, which, conducted by the nerve trunk and which we may designate as X^1, is analyzed in the cortical center, so that we get the perceptions of the tones a, b and c.

The theory of a peripheral tone analysis is inseparably connected with the Helmholtz resonator theory of tone perception. Long before the time of Helmholtz, however, the idea had found expression that the perception of the various tones takes place in separate parts of the cochlear tube, the higher tone in the basal coil, the lower tones near the apex of the cochlea. It was Helmholtz, however, who gave this theory its greatest scientific support, and especially emphasized how such a selective action in the cochlea was possible, on the principle of physical resonance. This theory of a peripheral tone analysis is not only the fundamental principle in the resonator theory of Helmholtz, but it is the fundamental conception in all the important theories of tone perception that have been advanced since the time of Helmholtz.

From purely anatomical reasons this peripheral specialization of function in the cochlea, the localization of, the perception of the various tones in separate parts of the cochlea, seems *a priori* to be probable for the following reasons: In the first place, the long rows of hair cells running from one end of the cochlea to the other constitute a mechanism admirably suited to the requirements of such a theory. In the second place, the elaborate mechanism found in the cochlea makes it highly probable that we have located here a peripheral tone analysis. Moreover, such a peripheral specialization of function, as has been pointed out by McKendrick, brings the organ of hearing in accord with the other special senses, as taste, smell and sight. Furthermore, to quote from McKendrick (Schaeffer's Physiology, page 1192), "The most obvious objection to any theory which dispenses with peripheral analysis is that it leaves the exceedingly elaborate structure of the organ of Corti, and, indeed, of the cochlea as a whole out of account, or, to put the matter in another light, it assigns to that organ a comparatively simple function (like that of a vibrating membrane), and one which could be performed by a more simple structure. Furthermore, the holder of such a theory, while recognizing the analytic powers we undoubtedly pos-

sess, must refer these powers to the cortex cerebri and practically admit that the problem cannot be solved."

The theory of a central cortical analysis was first advanced by Rutherford, and was called the "telephone theory" of tone perception. It was based upon the assumed existence of an analogy between the phenomena of hearing and that of an ordinary telephone device. This analogy, however, is not a true one, for while the telephone is capable of taking up a complex sound impulse, and of conveying it to a distant end-piece, where it is again reproduced unaltered, the telephone has no power of analysis. It is the same complex impulse which entered the receiver that is reproduced in the distant end-piece. The analysis which we perceive when listening at the telephone, is, of course, accomplished in the ear itself. The proposition can be graphically represented as follows: The complex impulse arising from the tones a, b and c, which we represented by X, impinges on the telephone receiver and is transferred as X^1 to the distant end-piece, where it is again reproduced, not as the tones a, b and c, but as the complex X.

Compare this with what takes place in the phenomena of hearing. The failure of the analogy is at once apparent. The actual tone analysis is, of course, accomplished after X enters the organ of hearing. It is immaterial whether this reaches the ear before or after it has passed through the telephone.

The statement has just been made that Ewald is a supporter of the telephone theory. Ewald's conclusion was based on observations he had made of the vibrations of a taut rubber membrane in an interesting ear model he had constructed. Ewald, proceeding from the hypothesis, which has been generally accepted since the work of Helmholtz on tone perception, that the membrana basilaris is the structure in the cochlea which is thrown into vibration by the impulse of sound waves, constructed an ear model in which a thin taut rubber membrane, varying in width from one end of the cochlea to the other, took the place of the membrana basilaris. On conducting sound waves into this model, Ewald was able to observe and to photograph movements of this taut rubber membrana basilaris. In these experiments Ewald found that instead of vibrating in separate segments, as the membrana basilaris should do, according to the Helmholtz theory, this rubber membrane, as a whole, was thrown into wave-like motions by every tone. Ewald concluded, on the basis of these experiments, that the membrana basilaris in the cochlea also vibrated as a whole in response to every tone, and that

the "sound pictures" thus produced were interpreted in the cortex, where, of course, the final step in perception takes place. This taut rubber membrane in Ewald's ear model bears no more resemblance to the complicated structure of the membrana basilaris than does a sheet to the strings of a pianoforte, and any demonstration of the possible action of this rubber membrane cannot be accepted as a demonstration of the probable action of the membrana basilaris. As a matter of fact, however, Ewald's theory of tone perception is as much a theory of peripheral analysis as is the resonator theory of Helmholtz. Ewald states emphatically over and over again that the idea that the nerve trunk acts as a whole in the conduction of sound impulses is untenable, and that it is absolutely necessary to have different groups of fibers in the nerve stimulated for the different tones. This peripheral analysis is accomplished in the Ewald theory by assuming that only those hair cells in the organ of Corti are stimulated which occupy the crests of the wave-like undulations of the basilar membrane. The different characters of the wave-like undulations produced by the tones of different pitch result in the stimulation of different groups of fibers for each tone in the scale.

The theory of a peripheral tone analysis, for reasons given above, seems *a priori* to be the probable one, whereas the telephone theory, the hypothesis of a central analysis, is entirely without scientific support.

There are other phenomena beside that of tone analysis that must be accounted for in a theory of tone perception. These are, in the first place, the so-called secondary phenomena of tone perception, and, in the second place, the occurrence of diplacousis, that is, the perception of a tone of a different pitch in the affected ear from that heard in the normal hearing ear; also the occurrence of certain peculiar types of subjective noises. Discussions of the occurrence of the secondary phenomena of tone perception, such as beats, difference tones, summation tones, intermittent tones, consonance, dissonance, etc., etc., has occupied a conspicuous place in the literature on the theory of tone perception. The problems are hardly suited for discussion here. The conclusions reached, however, are in accord with the theory of peripheral analysis. In fact, in the resonator theory of Helmholtz is found not only a natural explanation of most of these secondary phenomena, but indeed, their only plausible scientific explanation. The theory of central analysis, the telephone theory, has no satisfactory explanation for the occurence of these secondary phenomena.

Finally, the occurrence of certain peculiar symptoms in connection with pathological changes in the labyrinth, such as tone islands, diplacousis, etc., can be accounted for plausibly only on the hypothesis of a peripheral tone analysis in the cochlea. For example, the phenomenon of tone islands and of circumscribed defects in the tone scale, a condition which is known to occur only in connection with diseases involving the cochlea, is readily explained by the destruction of circumscribed areas of the organ of Corti, provided we accept the theory of peripheral tone analysis; whereas, if we accept the theory that all of the hair cells in the cochlea are stimulated by every tone, and that tone analysis is accomplished in the cortex, there appears no plausible explanation for the occurrence of this well-known phenomenon. The same holds true regarding the occurrence of diplacousis, where a tone is heard falsely in the affected ear. This is readily accounted for in the theory of a peripheral analysis by assuming a circumscribed alteration in the vibrating structure in the cochlea which caused a part of this structure to respond to a tone of a different pitch from that when in its normal condition. On the other hand, with the telephone theory referring the analysis to the cortex, there appears no explanation for the recurrence of this phenomenon.

The peculiar types of tinnitus aurium that occur in connection with diseases of the cochlea, for example, the development of tinnitus of a certain pitch, as the result of an injury to the ear caused by a shrill whistle of the same pitch, speak for a peripheral rather than a central analysis. Again, the finding of circumscribed areas of degeneration in the organ of Corti in animals previously subjected to shrill tones of a certain pitch, is in itself an actual demonstration of the existence of peripheral rather than of central analysis.

The following conclusions seem quite clear:

First: That the telephone theory of central tone analysis is not only untenable, but is entirely lacking in scientific support.

Second: That the theory of peripheral tone analysis in the cochlea is indispensable for the following reasons:

1. The elaboration of structures in the cochlea all point to the conclusion that a peripheral speciaiization, that is, a peripheral tone analysis, is located here.

2. A comparative physiological study of special sense organs points toward a peripheral specialization of function in all of the special sense organs. This is as true of the ear as it is of the other special senses.

3. The secondary phenomena of tone perception are plausibly accounted for only on the hypothesis of a peripheral tone analysis in the cochlea.

4. The peculiarities in tone perception that occur in connection with pathological changes in the labyrinth, such as tone islands, or defects in the midst of the tone scale, and the phenomena of diplacousis, as well as the occurrence of peculiar types of tinnitus aurium, argue in favor of a peripheral rather than a central tone analysis.

5. The production of circumscribed areas of degeneration in the organ of Corti as the result of exposure to long-continued overstimulation by intense tones of a certain pitch amounts to a practical demonstration of the existence of peripheral analysis.

No. 100 State street.

A New Method of Treatment of Acute Tonsillitis. DR. HAHN. *Bolletino delle Malattie dell' Orrecchio, naso e Gola*, No. 11, 1908.

After briefly describing the various curative methods for lacunar tonsillitis, the author explains his method, which unites the therapeutic principles of mechanical washing of the crypts and tonsils with the action directed against the inflamed condition of the organ. With a 5-cm. syringe and a cannula used for the catheterization of the cavities of the maxillary bone, a lukewarm mixture of oxygenated water and boracic solution (3 percent) is injected into all of the crypts and tonsillar cavities, followed by a solution of cocaine (2 to 5 percent) and adrenalin (1 percent), and finally an insufflation of orthoform. The author obtained recovery in twenty-three cases after only one treatment of each. Moreover, with his method, having scrupulously freed the crypts from all micro-organisms, he obviated the occurrence of relapses, made the process of recovery much shorter and lessened the tendency to chronicity in the inflammatory process LASAGNA.

THE TRANSMUTATION OF THE EPITHELIUM OF THE TONSIL INTO CONNECTIVE TISSUE CELLS.

BY JONATHAN WRIGHT, M. D., NEW YORK.

I take the opportunity of the interest which the recent observations of the experimental work on cancer in mice have excited in the actuality of the conversion of an epithelial growth into a connective tissue growth, often surmised in clinical experience, to advance more expressly some observations of my own which long ago undermined my belief in the integrity of the theory of the separate destiny of the blastodermic layers. In a more extended discussion[1] of the question of this mutability as it presents itself in the study of the various forms of cancer, I have alluded incidentally to the appearances presented by the basal layer of the epithelium in various chronic inflammations of the mucosa of the nose and throat, especially that presented by the epithelial layers covering the various forms of lymphoid hypertrophy. I have alluded to the basal-celled epitheliomata, in the classification of Krompecher, as furnishing evidence of a transition of type between a malignant hyperplasia of epithelium and a malignant hyperplasia of connective tissue; but in the tonsil we find, it seems to me, a still more convincing evidence of this mutability, a belief which some histologists look upon as the rankest heresy and the most revolutionary of tendencies in the study of normal and pathological anatomy. Now the intelligent study of pathological anatomy must be based on the knowledge of normal anatomy which we possess, but indisputable as this may be if we leave out of account the dynamic agencies of the pathological state in their influence on structure, and still more, if we are ignorant of all that has been revealed in general biology in the last few years, we are liable to go farther astray than if we are occasionally forgetful of the overworked embryological dogmas of a former generation. Just as a new environment throws a plant into a state of disturbed equilibrium which results in a wider sweep of the curves of variation, and may even result in a true mutation in the definition of De Vries, so a state of chronic inflammation such as we so commonly meet in the pharynx of adolescence furnishes a stimulus to variations in the morphology of the surface or glandular epithelium. The epithelial cells under this irritation exude horny

1. New York Medical Journal.

scale-like masses at the surface, which are often called pachydermia, after the animals which have owed their characteristics to the same variations and mutations in their phylogeny. The keratosis and the pachydermia of the pharynx and larynx have inadvertently acquired a nomenclature all the more significant biologically because laryngology has been innocent of participation in any biological strife as to evolutionary theory. So when we come to look for variations and mutations beneath instead of on top of the epithelial line, what do we find?

I avail myself of a quotation from an article of Cordes[2] written many years ago when he had little support from histological or biological theory and observation:—"The finer construction of these gland-like inversions of the mucosae of the pharynx [analogous to the tonsillar crypts—J. W.] in advanced instances is as follows: The external cell covering (i. e., those cells lining the cavity) consists of one or two or more layers of markedly flattened and partly detached pavement cells; then comes a zone which is composed of still plainly connected groups of epithelial cells, mixed with ovoid epitheloid elements. The latter cells have a smaller amount of protoplasm (cytoplasm) than the epithelial cells and a round bladder-shaped nucleus which resembles that of the epithelium but is somewhat smaller. In this zone one finds in the epithelial cells as in the other elements separate karyokinetic division figures; many epithelial cells or groups of the same send between the round elements long protoplasmic prolongations which are again connected with other similar cells; many isolated epithelial cells are long stretched out, the nucleus is flattened, and one recognizes protoplasmic prolongations running in various directions. Further towards the periphery the cells so situated often appear somewhat smaller and more of an oval shape; the nuclei are more easily stained, more rich in chromatin. Finally there follows in many places a zone which is composed of small typical lymphatic elements. We have to do here in no way with a simple process of lymphoid element penetration through the epithelium."

I have translated this long excerpt from Cordes in order to give him full credit for having arrived long ago at a conviction,—or near it at least, for I have not again read his article in full,—which I also have for some time entertained—viz., the conversion of epithelium into connective tissue elements under certain conditions of

2. Archiv. fur Laryngologie Bd. XII. 1902.—I am reminded of this valuable work of Cordes by a more recent article of Levinstein (ibid., Bd. XXI, hft. 2, 1909).

the mucosa of the nose or throat, in despite of the early teaching of my youth. How often this occurs I am not prepared to say. I have observed it most frequently in acute exacerbations of chronic inflammation of the tonsil. I have never seen a satisfactory indication of it without the presence of the hyperplasia of chronic inflammation. Over long stretches of the surface of the tonsil the genetic connection cannot be convincingly traced, but the observer will not infrequently arrive at fields under the microscope where the evidence is overwhelming and, to the unbiased mind, conclusive. Cordes, according to Levinstein, not only believes that the large lymphocytes are derived from the epithelium through gradations of so-called epitheloid cells, but that they form centers from which the smaller leucocytes are derived. Thus the epithelial layers furnish an endogenic center for the manufacture of a lymph node. This is also the view of Retterer, but it was radically opposed by Stohr.

I am prepared to accept the view that the lymphocytes are often derived from the epithelial cells and are subsequently transformed into fibroblasts and thus manufacture or help to manufacture the fibrous planes of the hyperplastic tonsil, but I have no reason to believe that this is the sole origin of the large lymphocytes of the tonsil. I cannot from my own observation say that in the tonsil the lymphocyte is the origin of the leucocyte, whether the former is derived from the epithelium or not, yet I believe that such is the case, since in other situations (bone marrow, the liver, etc.) it has been amply described by many independent observers. No one who has worked at the histology of the tonsil can fail on the other hand to confirm the statement of Stohr that the lymphocytes often penetrate the epithelial layers and lie in the crypt in great numbers. So far as my observations go, this occurs under practically the same conditions as,—and I believe it is partly a consequence of,—the proliferation of epithelium into lymphocytes in the lower line of the epithelium. Neither this migration nor this asserted mutation is seen in all areas. On the other hand, the latter in some places seems to have been so complete that the mutation has taken place even in the superficial layers. The usual interpretation put on this appearance is that the surface layers, or rather the whole thickened epithelial layer, has been desquamated, leaving the lymphocyte layer exposed. I do not believe that this explanation suffices to account for all the appearances noted in the examination of tonsils, though plainly it is seen to be the case in some; yet even

in these the question arises whether we have not to do with an artefact or with the result of trauma during the removal of the tonsil. I am constrained to believe that where the lymphocyte layer is thus exposed in acute exacerbations of chronic hyperplasia of the tonsil we have to do with a more or less complete transmutation of form at the point in question, at least in the majority of cases. I do not believe that phagocytosis by the lymphocytes has destroyed and removed the missing surface epithelium. When we come to study the phenomenon I have cited from Cordes we see that it is difficult,—I believe impossible,—to explain it on any other assumption than that the changed environment of chronic and the superimposed acute inflammation has wrought a transformation of the basal layers of epithelium in accordance with general biological laws, as applied to plants on the slopes of high mountains. The large mononuclear cells, plainly epithelial near the surface, gradually change their form as they stretch down a fibrous plane, sometimes almost seeming to invest it with a sheath from the inner layers of which fibres sprout. At any rate the protoplasmic exudates from these cells or fibrils may be seen interlacing with those of the fibrous stroma of the tonsil. I place no great stress on the karyokinetic figures which may be seen in these cells occasionally. That is incidental to the perturbation of the stimulus causing the inflammation.

While, as has been said, it is impossible for me to confirm from my own experience the origin of lymph nodes from a transmuted epithelial cell, I can testify to the formation of islands or nodules of small leucocytes or lymphoid cells with their supporting trabeculae ("Gitterfasern"), within the epithelial layers of the tonsil in chronic hyperplasia. I am not quite convinced as to how they come there. Small leucocytes in clumps with intercellular network are not infrequently seen, while separately, as almost naked nuclei, they are frequently seen between the epithelial cells. Levinstein's surmise that these nodes are formed from lymphocytes which have penetrated from below and have become flattened into a semblance to the epithelium, but at the same time forming the young lymphoid cell there, does not appeal to me.

The revelations,[3] unexpected as they are convincing, that the epithelial cell of adeno-carcinoma may suddenly change when transmitted by repeated inoculation of mice (a typical changing of environment) into a sarcoma cell, lends a force to these observations of Cordes as they strengthen the earlier heretical contentions of

3. Verhandlungen der Deutschen Geselschaft, 1908, 12te Tagung.

Retterer.[4] They furnish me also with a welcome support to an opinion slowly formed as the result of the cumulative observations of many years in the study of tonsillar histology.

Since the foregoing was written I have had occasion to make a report on the histological nature of a tumor from a case of Dr. Harmon Smith. The argument to be adduced from it has such a direct bearing upon the subject matter of this paper that I append it here as supplementary to it.

Lab. No. 4087, *Cl.* 526,369. *Surgeon—Dr. Harmon Smith.* *Nicolo Tomassino, act.* 50. There is a large protruding hard mass springing from the region of the right tonsil. No glandular metastasis can be made out, though the growth is very extensive, involving the ramus of the jaw and most of the side of the pharynx. Marked pain or bleeding is not complained of and marked cachexia is not apparent.

The growth was first noticed four years ago by the patient. Two years ago a piece was removed for histological diagnosis at Roosevelt Hospital, and that of *epithelioma* was made. The external carotid near its distribution to the growth was ligated and the tumor was left untouched as inoperable. Four years having elapsed since the growth was first seen, and the history of the growth being as above, the clinical diagnosis of *endothelioma* was made at the Manhattan Eye, Ear and Throat Hospital. A piece was again removed for microscopic diagnosis. Though large enough for ordinary diagnosis, there are many points raised in its examination which can be settled, if at all, only by examinations of the periphery of the deep-seated portions of the growth.

How far the ligation of the nutrient vessels may be responsible for the present morphology of the growth it is impossible to say. If the tumor in this situation had not destroyed the patient in the first two years, or at least extended far beyond reach, being at that time supposed to be of an epithelial nature, it does not seem likely it could have then presented the ordinary clinical characteristics of an epithelioma or sarcoma of the tonsil. At any rate, even if the procedure has modified the structure of the growth in the two years which have elapsed since then, I think it presents none the less very instructive and interesting features.

It is made up of the proliferation of two morphologically sharply separated cells as seen in their atypical condition. One order of atypical cell, much the smaller in amount, manifestly

4. Retterer: De la Structure de la Cellule Epidermique et des Facteurs qui la Modifient,—Journ. de l'Anatomie et de la Physiologie,—XLIV, No. 6, Nov. and Dec., 1908. This is a more recent contribution to the same effect.

springs from and is a part of the surface epithelium. It presents many of the characters of a flat-celled epithelioma or cancroid. Cancer whorls or nests are seen in the surface-line of the epithelium itself. A few digitations of such atypical cells shoot down into the area of the atypical cells, making up the bulk of the growth, to be described later. In addition, there are separate islands and whorls of this epithelium in the bordering territory of the tumor proper. Were it not for the presence of adventitious cells of another character in overwhelming numbers beneath, there could be no question that all histologists would call this growth a *flat-celled epithelioma.*

Amid the flat-celled surface covering even where the cells are atypical, may be seen sharply differentiated clumps of cells, evidently transverse sections of pole-like digitations thrust from below towards the surface. These are cells of the bulk of the tumor mass below. At deeper levels these cells are merged into the lower line of the surface, and usually along the border line they are indistinguishable from the basal cells. Deeper down still there is a gradual departure from this resemblance, but there is no merging of the appearance of the deep atypical cells with those of the surface. One extreme is of a malignant epithelial type and the other is of a malignant connective-tissue type. Such continuity as exists between them is through cells resembling and usually indistinguishable from the basal cells of the epithelium. Just as there are places where the fairly normal-appearing basal cells of the epithelium merge into fairly normal flat-celled epithelium—itself the origin of malignant cancroid-looking structure, as we have seen—so there are also such areas apparently giving rise to a mass of cells resembling large and medium-sized mononuclear lymphocytes and endothelial cells, with faint cell bodies and large round or oval nuclei. These are compressed in many places into polygonal shapes, and from these especially can be seen a cytoplasm giving origin to connective tissue fibrils, occasionally combined into large trabeculae dividing the growth into various-shaped compartments. Without examining the periphery of the tumor, it can not be positively stated that these cells furnish fibrii exudates making up *all* this low-grade stroma. It may be safely said, however, that some at least of the fibrils from the tumor cells compose the stroma. Running through the sarcoma tumor cell masses are some single-walled capillaries, whose cells have nuclei longer than and cell bodies somewhat differentiated from the tumor cells; such capillaries do not seem to spring from or accompany the coarser trabeculae just spoken of as partly at least made up of fibrils from the tumor cells. In many places these capillaries and some few of the cells seem as though they might be

derived from the stroma beyond the periphery of the growth. In other places they closely resemble and seem to spring from the neighboring tumor cells. Some of the larger of these capillaries and some of the thicker-walled blood-vessels are seen to be invaded by the tumor cells which are mingling with their haematocytes.

The condition of the cells as to karyokinetic figures can not be made out in any of the cells, though evidently they are present in some of them, and a more careful hardening might have revealed them.

There are three ways of interpreting the appearance of this growth, which, of course, in its structure presents most of the ordinary evidence of malignancy:—

(1) We may regard it as a mixed growth. A malignant hyperplasia of the surface epithelium encroached upon and in some places invaded by a malignant hyperplasia of the endothelium of the lymph spaces, the two forms to a certain degree invading one another along a border territory roughly coincident with the basal cells of the epithelial covering, may be said to sum up one view of it—in other words, a combination of endothelial sarcoma and epithelioma.

(2) We may regard it as a malignant proliferation independently affecting two separate layers of epithelium.—in other words, a combination of flat-celled epithelioma and the basal-celled epithelioma of Krompecher.

(3) My own conviction is that we have here a revelation of the latent power of the basal cells of the epithelium to be transmuted into connective tissue or into flat surface cells under certain conditions. I regard the process as fundamentally one process; that is shown by the dynamics revealed in the clinical history. Neither sarcoma nor epithelioma of the tonsils or fauces runs any such clinical course as this,—why should a combination of them do so? This growth, in my opinion, started in a border domain of cells which under other conditions also exhibits evidence of being easily upset in its morphology by unknown molecular forces. A mild molecular disturbance has here occurred, which, if confined exclusively to the stroma, or exclusively to the epithelium, would not have been sufficient to cause cancer. Occurring here in cells with a tendency to mutation,—with an unstable equilibrium, in other words,—we have the combination exhibited by structure and by vital dynamics of a feeble potentiality. I do not see how any other hypothesis can satisfactorily account for the condition.

No. 44 West Forty-ninth Street.

BRONCHOSCOPY AND OESOPHAGOSCOPY: THE TECHNIQUE, UTILITY AND DANGERS.

BY E. FLETCHER INGALS, M. D., CHICAGO.

The history, anatomic conditions, instruments and technique of this procedure have been so admirably presented and in such detail by Chevalier Jackson in his excellent monograph on the subject that I need not take your time with an exhaustive paper.

I shall therefore present only those features that appear to me of special importance to the operator, but in doing this I shall necessarily repeat some things that I have said before and also some that are dwelt upon by Jackson and other authors. I feel that much has yet to be done in the development of this most valuable operation, especially in learning to avoid its dangers.

Before attempting bronchoscopy on the living patient, one should make every possible effort to acquire dexterity by practice with the tubes, lights and forceps. For a beginning one may practice with a tube, the distal end of which is held in the closed hand. In this way he may learn something of the difficulties and the means of overcoming them; but the view thus obtained is much more distinct than in a congested and swollen bronchial tube, more or less filled with secretions and blood. The same statement applies to rubber manikins designed to represent the trachea, bronchi and esophagus, and it appears to me that they are little if any better than the closed hand. Practice on the cadaver is only a little more valuable than the methods just spoken of, because the pale, dry, motionless air-tubes are so very different from the conditions found in the living patient.

A medium-sized dog furnishes the best subject for practice. The animal should be anesthetized but not so deeply as to prevent the normal expansion and contraction of the air tubes in respiration. The trachea does not expand or contract to any extent in adult dogs or humans, but its movements, especially at the lower part, are very pronounced in small children and puppies. The bronchi, however, at least beyond the first division, may contract in expiration to half the diameter of inspiration, or a small bronchus may absolutely close over a small foreign body so that it cannot be seen at all.

As an anesthetic, Jackson recommends for these animals scopolamin 1/100 gr. with morphin 1/2 gr., and suggests also chloretone

*Read at the meeting of the Southern Section of the American Laryngological, Rhinological and Otological Society, held at Richmond, Va., February 12-13, 1909.

15 grs.; either of these to be given hypodermatically an hour before the operation and repeated if anesthesia is not apparent twenty minutes before the practice. I would suggest for the purpose morphine grs. 2 to 3, and chloretone grs. 15, for a 25 lb. dog, supplemented at the time of the practice, if needed, by a small amount of chloroform. This dose of morphine appears large, but dogs tolerate excessive quantities of this drug. The chlontone may be given by mouth in solution in fifty percent alcohol.

Diagnosis.—The diagnosis should be as carefully made before attempting this operation as before almost any other surgical procedure. For this purpose we must inquire very carefully into the history and ascertain, if possible, whether the foreign body has been swallowed, or aspirated into the air passages. Patients are frequently brought to the physician with the statement that they have swallowed a foreign body, regardless of whether it entered the esophagus or was aspirated into the larynx or trachea. The presence of dyspnoea points to location of the foreign body in the air passages, although pressure from a large body in the esophagus might cause the same symptom. Pain is sometimes experienced in the region of the foreign body. If the patient is hoarse or the respiration is stridulous, the chances are that the body is lodged in or close to the glottis.

The physical examination should be thoroughly made, and every laryngologist should be an expert diagnostician of thoracic diseases. If a foreign body has been drawn into one of the bronchi, there is likely to be disparity in the respiratory movements of the two sides. If inflammation or collapse of the lung has resulted, more or less dullness should be detected. The respiratory murmur on the affected side is usually feebler than upon the sound side, and it is commonly attended by many bronchial rales. Where the foreign body remains in the trachea, this difference in the two sides is not noted, but usually there are many rales, which with a history of perfect health before the accident are strong presumptive evidence of the presence of a foreign body. Small foreign bodies may be lodged in a bronchus without causing disparity in the respiratory murmur on the two sides, but they commonly cause somewhat localized moist rales. Metallic bodies, pebbles, bone and glass, as well as some of the more compact organic substances, cast shadows which may be more or less readily seen in a good radiograph. These can sometimes be seen with the flouroscope but not nearly as well as in a radiograph negative. Seeds, small pieces of wood, particles of food, etc., do not cast shadows. Jackson suggests that we must

rely upon the interpretation of an expert in radiography; this is helpful but may be misleading. In one of my early cases the operator assured me that the shadow cast by the spine of the scapula was a foreign body in the lung. A shadow from this source would only be likely to cause confusion when the arm had been extended above the head while the picture was being taken. With no history excepting that of a suddenly developed cough, a radiograph will sometimes reveal a metallic foreign body, as in a case I have seen recently where the friends had no suspicion that anything had been inhaled, yet a small nail was found in the lung.

Having established the diagnosis beyond a reasonable doubt, the next question is whether one shall perform an upper bronchoscopy, through the natural passages, or a lower bronchoscopy through an opening in the trachea. This may depend upon several circumstances, but I have come to believe that whenever marked dyspnoea is present, safety to the patient demands a preliminary tracheotomy. In other cases it would generally be better to first attempt upper bronchoscopy because if one succeeds in this way he avoids the dangers of tracheotomy and the subsequent scar which would be annoying, especially in a girl, and he avoids also much opposition from the friends of the patient. Where the foreign body is deeply seated in the lung and at a considerable distance from the median line, especially if upon the left side, lower bronchoscopy would nearly always be better. Experience has led me to believe that in nearly all cases, unless one succeeds in finding the foreign body within ten or fifteen minutes by upper bronchoscopy, the trachea should be opened, because lower bronchoscopy is much less difficult than the upper; for the tubes may be better illuminated, they can be more easily passed into the bronchi, and shorter and larger tubes may be employed. It would generally be safer to defer the lower bronchoscopy a few days until all irritation has ceased.

Anatomy.—A knowledge of the anatomy and physiology of the air passages and esophagus are essential to good results in bronchoscopy and esophagoscopy. The teachings of the older anatomists were misleading, especially regarding the trachea and bronchi, and the majority of physicians (even laryngologists) have not had their attention called to the errors; therefore, I may be pardoned in this connection for asking your attention to a few anatomical facts.

From its origin, immediately below the cricoid cartilage, the trachea runs downward and backward into the chest and slightly to the right. At the level of the second costal cartilage in adults,

and at the third in children, or opposite the third intervertebral cartilage in adults or the fourth in children, it bifurcates into the main bronchi, the right of which is the larger but shorter. The demonstrations of Aeby (Der Bronchialbaum des Menschen und der Saugetiere, Leipzig, 1880), which have since been confirmed by other anatomists and are now generally accepted, show that the teachings of the older anatomists that the right bronchus runs nearly horizontally into the right lung and the left much more obliquely downward into its lung are rarely if ever correct. Professor R. R. Bensley of the University of Chicago confirms Aeby's statements, and Professor J. Gordon Wilson, formerly of the University of Chicago, now of the Northwestern University Medical School, from numerous recent disections has arrived at nearly the same conclusions. There is considerable variation in the direction of the bronchi in different individuals, but in a considerable proportion the right runs at a much smaller angle from the median plane downward and backward into its lung than does the left. In some cases indeed the right bronchus is almost a direct continuation of the trachea. The left bronchus turns more nearly horizontally to the side, running downward and backward. Aeby states that on an average the right bronchus makes an angle of 24.8° to the mesial plane, whereas the left bronchus diverges on an average of 45.6° to this plane; in children the bronchial angle is less than in adults. The left bronchus, which is in the adult about 10 mm. in diameter, is usually from 1 to 2 mm. smaller than the right bronchus, but it is nearly twice the length of the latter, and not infrequently its first branch which passes *upward* and outward to the upper lobe is even larger than the continuation of the main stem. This branch is usually larger than the corresponding branch of the right side, its average diameter being 9 mm. Professor Wilson's observations show that the first branch from the right main bronchus runs *downward* and outward to the upper lobe of that lung and that it averages 8.5 mm. in diameter.

It was formerly taught that the bronchi divide and subdivided dichrotomously. This is not quite correct, although there was considerable reason for the statement, as the branches are often of nearly the same size, but there are frequently three branches given off at nearly the same point, and in different subjects these vary much in size, although the combined calibre of the subdivisions is somewhat greater than that of the tube from which they spring. It would generally be better to consider the bronchus of each lung as one main stem starting at the bifurcation of the trachea, running

downward, more or less backward and outward toward the posterior part of the lung to a position about 8 cm. from the middle line of the body. From these main stems large branches are given off to the upper lobes, which shortly give off two or more smaller branches. Upon the right side a branch is also given off to the middle lobe. The main stems also give off branches arranged in anterior or ventral and posterior or dorsal sets. The ventral, which are also the outward of these branches, are often nearly as large as the stem from which they are given off. The branch to the upper lobe on the right side is usually given off about 1.5-2 cm. from the beginning of the main bronchus, but that on the left is given off at about 5 cm. from its origin. The left main bronchus generally runs more nearly horizontally than the right, and it is probably from this condition that foreign bodies lodged in the branch going to the left upper lobe are often much more difficult to detect than those in the subdivisions of the right bronchus; indeed in not a few cases, owing to the position of this branch, the congestion and swelling of the mucous membrane and the secretions and the blood in the bronchi, the operator will be unable to detect foreign bodies in this bronchus at all. The dimensions of the tracheo-bronchial tree taken from the cadaver according to figures compiled from Jackson and others are as follows:

	Average length and size			
	Adult Male	Female	Child	Infant
Diameter of Trachea	14-20 mm.	12-16 mm.	8-10 mm.	6-7 mm.
Length of Trachea	12 cm.	10 cm.	6 cm.	4 cm.
Length of right bronchus	1.2-2 cm.	1.2-2 cm.	1.3 cm.	1 cm.
Length of left bronchus	4.5 cm.	4.5 cm.	3 cm.	2.5 cm.
From upper teeth to trachea	15 cm.	13 cm.	10 cm.	9. cm.
From upperteeth to bifurcation of trachea	27 cm.	23. cm.	16 cm.	13 cm.
From upper teeth to secondary bronchi going to the upper lobes of the lungs	29-32 cm.	25-28 cm.	17-19 cm.	14-15 cm.
From upper teeth to branches going to lower lobes	32-32 cm.	28-31 cm.	20-23 cm.	

From recent dissections on adult bodies, Professor Wilson furnishes the following table:

	Distance from bifurcation of trachea.	Diameter
Right bronchus:		
Branch to upper lobe of lung	1.2 cm.	10 mm.
Branch to middle lobe	4. cm.	8.5 mm.
Main bronchial stem at this point		8-9 mm.
First lateral branch to lower lobe	4.3 cm.	4.5-6.5 mm.
Left bronchus:		
Branch to upper lobe of lung	4.8 cm.	9. mm.
Main bronchial stem at this point		8-9 mm.
First lateral branch to lower lobe	5.6 cm.	6 mm.

These measurements, however, are only approximate and are subject to much variation. They do not allow for the dilatability of the air tubes during life, neither do they allow for the contraction. The dilatation that can be done with safety I think very slight, but, unfortunately for the operator, the expiratory contraction of the bronchi, especially in the young, and the swelling of the mucous membrane, may make the tubes very much smaller than they would be in the cadaver. It is especially important to know the length of the trachea and bronchi and the probable distance from the upper teeth to the bifurcation of the trachea and to the first and second divisions of the bronchial stems. This varies considerably in different cases according to the size of the individual, the length of the neck and the shape of the chest, but before beginning the operation one should make as accurate an estimate as possible from the size and form of his patient and the radiographic negative or physical signs in order to select a tube of proper length. Usually the bronchoscope should be from 4 to 6 cm. longer than indicated by these measurements, in order to allow for error in the estimate and for convenience in manipulation. Occasionally tubes much longer than estimated will be needed, but these are commonly smaller so that they can be introduced through the larger and shorter tube. Jackson states that to reach below the first branches of the main bronchi tubes 45 or 50 cm. in length will sometimes be required. I call special attention to this because I was obliged to learn it by painful experience.

Throughout the lungs the pulmonary arteries and veins accompany the bronchi, the smaller arteries lying behind the bronchi and the pulmonary veins upon the opposite side from the artery. The bronchial arteries and veins also run along the posterior walls of the bronchi.

Preparation.—Careful aseptic precautions should be taken for this operation, even though perfect asepsis cannot be secured because there are so many microbes constantly in the mouth; yet we must protect our patients from every avoidable risk. Jackson very properly suggests that when lower bronchoscopy is to be done, it is advantageous to do it immediately after the trachea has been opened, for if delayed a few days there is more chance of carrying infection to the lower portion of the lung from a suppurating tracheal wound.

When operating under a general anesthetic, a table should be used which will permit of dropping the head considerably lower than the body, and a low stool is necessary for the operator, with a high stool for the assistant who holds the patient's head.

In doing bronchoscopy I have several times received severe electric shocks, and I suspect that patients have also received them, although I have not been certain of this excepting once. For this reason it is desirable to have a table with rubber casters and to have the floor covered with rubber sheets so that the operator and all the assistants will be insulated; or everybody who is about the patient should wear rubbers and rubber gloves. I have found that the placing of my stool on a sheet of rubber and wearing rubbers and rubber gloves has prevented me from getting shocks.

It is desirable to have two or three sources of light, all of which should be carefully tried out before the operation, otherwise at a critical point one may be left in darkness. Kirstein's or Killian's light, Guisez's head lamp or von Schroetter's, Casper's, Rosenheim's or Leiter's lamps attached to the handle all have their advantages and defects. The small lamp that I have employed, introduced through the bronchoscope, or Einhorn's or Jackson's small lamps introduced through an auxiliary tube in the wall of the bronchoscope, also have their good and bad features. I think that the secretions and blood getting into the auxiliary tube of Einhorn's or Jackson's bronchoscopes make it more difficult to keep the lamps clean than when they are introduced through the bronchoscope. The main objection, however, to Einhorn's and Jackson's bronchoscopes is that they necessitate using an instrument 1 or 2 mm. smaller in calibre than the Killian bronchoscope that could be employed in the same case. Usually the largest size that can be safely used is needed. However, the particular instrument to be employed will be determined by the judgment or whim of the operator. I have used the Kirstein and Killian lights and Jackson's and my own small lamps, and I have at least two kinds in readiness at each operation. In one operation both of them gave out at the same time before I had finished. I have used the street current with reducing rheostats for all of these lamps, but I believe we should adopt Jackson's suggestion and use only a primary battery for the small internal lamps, because by this method the patient could not get a severe shock, whereas it might occur if the light carrier which passes down to the end of the bronchoscope were connected in any way with the street current or a storage battery. It is also important that the conducting cords for the aspirator pump and the various lights should not come in contact with each other during the operation, lest there be some weak point where there might be a short circuit.

An aspirator for removing the secretions and blood or pus from the bronchi is provided with most of the sets and is important; but the hand aspirator acts slowly and not very satisfactorily as compared with a small pump driven by an electric motor. I have used with great satisfaction the pump which I think was devised by Dr. Jackson for the purpose of massage for the ear drum.

A gag is necessary at least during the early part of the operation. Allingham's mouth gag I have found most satisfactory. Killian's split tubular spatula or Jackson's tubular spatula, one

Fig. 1. Author's open tube speculum or laryngoscope.

side of which may be opened by removing a slide, or my similar open-tube spatula (Fig. 1) are very helpful in introducing the bronchoscope, though in most of my operations I have used my introducer, which consists of a copper staff bent so that it can be introduced as in laryngeal intubation. Over this is passed a thin spiral steel tube, the end of which is left in the glottis when the staff is withdrawn. A long metal tubular director, 5 to 6 mm. in outside diameter, is then introduced through the spiral tube past the glottis into the trachea, and the spiral tube is then removed; over this director the bronchoscope can easily be passed into the trachea. The introducer is applied before the patient's head has been bent far backward, but the tubular director is introduced through the spiral tube with the head far back in the position for

bronchoscopy. I have used Killian's, Bruning's and Jackson's bronchoscopes, but on the whole I like Killian's the best; however, either of the others may be preferable in certain cases. The length of the tube should be determined beforehand by actual measurement from the supposed site of the foreign body or the part of the tracheo-bronchial tree to be examined to the upper teeth, and to this distance for upper bronchoscopy should be added 4 or 5 cm. For lower bronchoscopy much shorter tubes can be used. The size of the bronchoscope will depend upon the age and size of the patient; the larger the tube that can be used with safety the better. In infants for upper bronchoscopy the tube should not exceed 5 mm. in diameter. In older children it may be 6 or 7 mm., and in adults 9 mm. in diameter. Ordinarily for children bronchoscopes 7 mm., for adults 9 mm. in diameter are employed. Mandrins are usually desirable, that will just fit these tubes, with smooth ovoid ends projecting beyond the bronchoscope and that are so made as to allow the patient to breathe through them. It is important too that the bronchoscope should have several openings through its wall beginning about 4 cm. above the distal end, in order that when one bronchus is closed by the tube, the patient may respire through these openings. Jackson recommends for lower bronchoscopy tubes 8 mm. in diameter, by 20 cm. in length for adults; and 5 mm. x 14 cm. for children. For upper bronchoscopy tubes 7 mm. x 45 cm. for adults, 5 mm. x 20 cm. for infants, and 7 mm. x 20 cm. for older children. For upper bronchoscopy I have seen no harm from the employment of a tube as large as could pass the glottis without difficulty, and for lower bronchoscopy a tube 1 to 2 mm. larger can be employed. A number of cotton holders long enough to reach through the bronchoscope must be on hand, and they should be so made that the cotton will be fastened firmly. I have used only the cotton holders furnished with Killian's set, but those devised by Dr. Coolidge that are fastened by a ferrule which is screwed down are better. On one occasion* I had a swab of cotton come off in the bronchus, and at another time, while cleaning a bronchoscope I had cotton which I supposed was firmly fastened come off two or three times. This shows that great care should be given to these instruments.*

Numerous forceps have been devised, any of which, if small enough and long enough, may be satisfactory to different operators. I like the Killian forceps best. Different forms of blades are

* Since writing the above I have about concluded that narrow selvedge edged gauze would be preferable for removing the secretions from the bronchi. I have had made a slender forceps for passing it down.

necessary according to what is to be accomplished. Blades that will grasp firmly any small object are essential, others that when closed have 4 to 5 mm. between them are necessary in removing such objects as peanuts and beans in order that they be not crushed. Cutting blades are occasionally needed, and blades roughened exteriorly that may be introduced within tubular objects and then sprung out so as to hold them are sometimes necessary. Blades that may possibly do damage by catching and tearing the soft tissues should not be employed if it is possible to get along without them. In two or three cases I have derived great advantage from a little instrument that I have named a pin finder, made somewhat on the principle of a corkscrew with a blunt end, the object of it being to work the pin as nearly as possible into the center of the lumen of the bronchus so that the bronchoscope may be slipped down over it. Ingenious safety-pin closers have been devised by Mosher and Jackson which are very important instruments when an open safety-pin is lodged with the point upward. Various hooks are also recommended and will sometimes be found very useful, but I wish specially to caution operators against the use of a hook bent so far that it may possibly catch into a bronchus. A hook 4 mm. across could easily be passed into a bronchus only 3 mm. in diameter, but on attempting to withdraw it, it might catch into a branch of this small bronchus, and in such case it might be impossible to disengage it without tearing the lung. Tearing the lung in this location would almost necessarily result in emphysema which would probably prove fatal; it might be attended by serious hemorrhage, or it might be the starting point of a dangerous broncho-pneumonia or pleurisy. I think that a long snare armed with No. 4 or possibly No. 6 piano wire would sometimes be a valuable instrument as a shorter snare is in removing foreign bodies from the nares. I always have such an instrument with me, but have not yet had occasion to use it. Magnets have been used for removing iron objects from the air passages, but generally, when the foreign body has been in the air passages for more than two or three days, there is so much swelling that the body is held so firmly that a magnet is useless. It is probable that in some cases an instrument like a corkscrew that could be screwed directly into the center of the foreign body might be useful.

A sterilized tracheotomy set should always be on hand in case it should be necessary to open the trachea. An O'Dwyer's intubation set is sometimes valuable. In a recent bronchoscopy I accomplished the same end very quickly by introducing my tubular

director, 5 mm. in diameter, though the glottis. It may sometimes be better for emergency than either of the others. For the removal of granulation tissue and tumors small curettes set at right angles to the stem are very useful.

Anesthetics.—Local anesthesia has been relied upon largely by Killian, von Schroetter and others, but I have preferred general anesthesia. For short examinations cocaine and suprarenaline are better where the patient is not too nervous; but in children general anesthesia appears preferable, though von Schroetter told me that he relies on local anesthesia even for these little patients. Chloroform is usually employed as a general anesthetic because it is less likely than ether to cause subsequent inflammation of the lungs and it does not cause so much secretion. It may be administered at first with an ordinary mask, but, after the bronchoscope has been introduced, some inhaler is needed which will enable the anesthetist to force in the vapor through a small bent tube that can be held over the end of the instrument. Several inhalers are made for this purpose. I use the Brophy. Before beginning an operation a moderately full dose of morphine and atropine, appropriate to the patient's age and size, will make it possible to get along with a smaller quantity of the anesthetic, and at least in adults I believe will render the operation safer. Atropine tends to minimize the amount of secretion within the lungs, and morphine renders the mucous membrane less sensitive. The use of cocaine combined with some of the suprarenaline products also enables one to get along with smaller quantities of the general anesthetic. In my operations the patients have not been kept profoundly under the chloroform. Some operators consider cocaine perfectly safe, but from the numerous unpleasant symptoms that I formerly saw when using it in the nose and from many recorded fatal cases of cocaine poisoning, it seems necessary to employ it with considerable caution. Two fatal results following bronchoscopy in children in whom I employed cocaine, and in one or both of whom moderate amounts of morphine and atropine were also used, have made me fearful about these drugs, although I have not yet been able to reach any satisfactory conclusion as to the exact cause of death in either case.

Technique.—Dr. Jackson gives very precise instruction about the arrangement of tables and the positions of the various assistants. I have found it important to have a reliable man to hold the patient's head; indeed, I feel that my first difficult bronchoscopy was successful largely because my assistant held the head in such a vise-like grip when it had been placed where I wished it, that it did not

move. On the other hand, one of my most dismal failures was with the assistance of a man who allowed the head to move about, thus costing me much time as well as annoyance. Beside the assistant who holds the head, there must be an anesthetist who will attend strictly to this part; an assistant who should attend to the lights and aspirator, a nurse to prepare the cotton swabs, and another to do whatever may be needed at the time.

Nearly all of my bronchoscopies have been done with the patient lying upon the back, the head hanging over the end of the table, with the first assistant placed at the patient's left upon a high stool, holding the head resting upon his knee. Sometimes I have found it desirable to have the head slightly higher than the axis of the body, but usually lower. It is important to have a table which will allow one to raise the head, or to depress it into a semi-Trendelenburg position if the patient is not bearing the anesthetic well. Jackson recommends that the patient be kept in this position for some time after the operation, especially when a tracheotomy has been done. Killian and von Schroetter have done nearly all of their bronchoscopies under cocaine and I judge have usually had the patient in a sitting position. It would appear to me very difficult to manage children in this way. I have the anesthetist on the patient's right; the assistant who manages the lights slightly behind me and to my left; the table for my instruments and the nurse who attends to the cotton swabs at my right. Sometimes I have two persons assisting with the swabs, for it frequently happens that the aspirator will not remove the secretions satisfactorily and then much swabbing may be needed.

The instruments should be carefully sterilized, but it is best to rely upon alcohol, or carbolic acid followed by alchohol, for the tubes and the light carriers, as boiling would dim the polish of the bronchoscope and it would injure the light carrier. I have my instruments placed on a table at my right, and on the lower shelf of the table have a large pan of hot water in which the instruments can be warmed or rinsed, with another pan of alcohol in which instruments can be again sterilized. Where there is much secretion or where the patient coughs frequently, the eyes should be protected either by large glasses, or a pane of glass held by an assistant between the operator and the bronchoscope. It is well to lubricate the bronchoscope with vaseline before its introduction. At first I experienced much difficulty in introducing the bronchoscope which I now think was largely due to not having the tongue drawn out, and to not using my introducer or a suitable tubular spatula which

had not been invented at that time. Killian draws the tongue out as far as practicable, and this appears to render the introduction of the bronchoscope much easier, but it is not necessary when my introducer or the tubular spatula is employed.

Care must be taken that the bronchoscope does not injure the patient's lips; this may be avoided by placing a folded napkin under it over the teeth, or the lip may be watched by an assistant.

Whatever method is employed in the introduction of the bronchoscope, one should be careful not to get it into the esophagus, which is much easier to enter than the larynx. If the tube should be passed into the esophagus, it must always be cleaned and again sterilized before again attempting to pass it into the trachea.

Among the difficulties that will be met in doing bronchoscopy are: rigidity of the neck, especially when only a local anesthetic is used, spastic muscular contractions, cough and excessive secretions, and respiratory difficulties due either to the foreign body or to the inflammation it has caused. In my first bronchoscopy the patient had difficulty in respiration because the tube had no fenestrae to allow the air to pass through it into the other lung. Afterward I had about twenty small lateral openings made in all of the tubes. These were only about 1.5 mm. in diameter.

When the bronchoscope has entered the trachea, it should be passed down gently while carefully inspecting the parts until the antero-posterior septum at the bifurcation is found; then it should be inclined to the right or left according to the lung that we wish to enter, the head and neck being turned at the same time in the opposite direction and the bronchoscope to the opposite side of the mouth so as to minimize the strain on the trachea and bronchi. In most cases there will be little difficulty in finding the main bronchus, but sometimes the lower portion of the trachea is filled with secretion that must be removed before the parts can be seen. In young children the trachea may contract in expiration in the same way that the bronchial tubes do in adults; therefore, it will not always be found easy even to get into the main bronchi; but generally the operator after a little experience will not have much trouble in this respect. In passing the bronchoscope into the right lung we expect within about 1.5 cm. of the bifurcation, at its upper outer part, to find the mouth of the bronchus which supplies the upper lobe of the lung. On the left side, after the bronchoscope enters the main bronchus, it should be passed along gently for 4 or 5 cm. while the operator carefully inspects the upper outer wall for the beginning of the branch going to the left upper lobe.

This bronchus on the right side runs downward and outward so that it is not very hard to follow; on the left side, however, it runs upward and outward and sometimes it is very difficult to find. There are numerous branches given off the main bronchial stems, but it must not be supposed that the operator will be able to recognize the orifices of all of them. Three to five at most are all that can usually be seen on either side.

The operator is sometimes confused by the reflections of light from the inner surface of the tube. This is best overcome by employing a small lamp carried down to the end of the bronchoscope. The secretions and pus or blood in the trachea or bronchi may prevent inspection of the parts and sometimes it is very difficult to remove them sufficiently to make a thorough examination. For example, in a pulmonary abscess the end of the bronchoscope is likely to be closed by pressure against the wall of the cavity. When the tube has been cleaned out, a slight movement will allow more pus to enter and thus the operator may find himself delayed for a long time before he is able to inspect other parts of the cavity. Vision is not infrequently interfered with by swelling of the mucous membrane or granulation tissue, sometimes by contraction of the bronchus above the foreign body by cicatricial tissue, and it is always more or less interfered with by the normal contractions of the bronchial tube that may be exaggerated or may even be continuous in the presence of a foreign body. Foreign bodies after remaining for a long time in the air passages may become encysted so that they cannot be seen at all.

Jackson states that when the foreign body has passed so far into a small bronchus that it cannot be seen, its presence may be suspected because of the outcoming exudate or secretion which will show the operator in which branch to search for it, but I have not noticed this phenomenon. Gentle probing may enable the operator to discover the foreign body. I like best for this purpose the long slender tube that I generally use for aspirating the secretions, or a slender forceps with narrow blades, the ends of which are so fashioned that they can do no harm.

In the case of small bodies like pins or needles, the pin-finder will sometimes bring them into view and enable one to pass the bronchoscope over them so that they can be grasped by the forceps. Small bodies in small bronchi may very easily escape detection, especially when they are not of metallic character so that their location can not be determined by the radiograph.

One is not justified in searching long through the bronchial tree unless he is sure that a foreign body is present. Foreign bodies lodged in the branches of the bronchi that run to the upper lobes, especially that of the left lung, have in my experience been the most difficult to detect.

Utility.—Bronchoscopy may be valuable in the diagnosis of some conditions of the upper respiratory passages when they cannot be determined by other means; thus in certain cases we may discover involution of the trachea from the pressure of a goitre, enlarged thymus, aneurism or other mediastinal tumor. I am fully convinced, however, that simply for diagnosis this method should seldom be used excepting where an accurate diagnosis cannot be made by ordinary laryngoscopy and the usual methods of physical examination.

Bronchoscopy is of greatest value for the detection and removal of foreign bodies from the larynx and tracheo-bronchial tree. Most foreign bodies, after they have been located, can be best grasped with tubular forceps, the blades of which cannot damage the surrounding tissues. After it has been seized, if the body is too large to be removed through the tube, the tube and foreign body are withdrawn together. The forceps should be marked by a narrow strip of adhesive plaster wound around it so that the operator may know when it reaches the lower end of the tube. Having located the foreign body, one may sometimes grasp it while it is in plain sight, but commonly the forceps so obstructs the view that this is difficult. In such cases if forceps are used that have no sharp teeth to injure the lung, the instrument may be passed down in such a position that when the blades are opened they must pass on each side of the body; then when the mark upon the stem shows that the end of the forceps has nearly reached the body, the blades are opened, and the instrument passed in about 1.5 cm. farther when the blades may be closed with as much assurance of catching the object as though it were under direct inspection. However, where the body is of such a nature that toothed or cutting forceps must be used, it should not be touched excepting under direct inspection. For foreign bodies like kernals of peanuts, or beans or peas which are softened so that they might be crushed by blades that close tightly, forceps should be employed in which the blades cannot be approximated much nearer than the diameter of the foreign body, otherwise the body will be broken into fragments and many of them are likely to remain in the air passages.

Laryngeal tumors can sometimes be removed by direct laryngoscopy more easily than by the older method, especially in children,

or in other patients where a general anesthetic is necessary. Whenever operations of this kind are to be done, they should usually be preceded by tracheotomy; if not, the operator must have at hand a tracheotomy set or a set of O'Dwyer's tubes and be prepared to act at once and rapidly in case of sudden closure of the larynx by swelling or spasm. Laryngeal stenosis from cicatrices may sometimes be readily relieved, and tracheal tumors or granulation tissue can be removed by this method. Stenosis of the trachea or bronchi has occasionally been satisfactorily treated by the aid of the bronchoscope. Oedema of the larynx may be easily reached and relieved by the tubular laryngoscope, though it can generally be satisfactorily and more readily handled by other methods. Abscesses of the larynx that cannot be opened in the ordinary way will often be found amenable to treatment by this method. Ulcers of the trachea and the bronchial tubes have been cured by the aid of the bronchoscope that could not be reached in other ways.

It has been suggested that cavities in the lungs might be satisfactorily explored and treated through the bronchoscope. While believing that this could be done in exceptional cases, I think that the exploration would not be justifiable unless there was reason to believe that the cavity contained a foreign body, and I doubt very much whether there are other cases in which any treatment that could be applied through the bronchoscope would be of much value. However, I must admit that in one of my patients, freeing the opening into the cavity by bronchoscopy caused speedy betterment in the patient's condition that steadily improved until he contracted pneumonia three years later.

Dangers.—Those who have had a few successful cases of bronchoscopy are apt to become very enthusiastic over its possibilities without recognizing its dangers, and therefore it has been recommended in many conditions where it is not indicated. At first sight it appears a simple thing to pass a small tube through the trachea into the bronchi, and it would seem that if the operation were done gently, no harm would result. It has been shown, however, that the operation is far from being either easy, simple or devoid of danger. The primary danger comes from the anesthetic, which if general becomes especially hazardous in the presence of dyspnoea. Most operators who rely on local anesthesia speak of it as perfectly safe, but one cannot understand how they overlook the possible dangers from the absorption of cocaine, when numerous fatal cases have resulted from its use in other parts of the body. It would seem that cocaine applied so closely to the nerves controlling the respiration and circulation might have a serious

effect. A general anesthetic when the patient is suffering from dyspnoea is attended by much danger especially if tracheotomy has not first been performed; but in any case it is important that the anesthesia be not too profound or too long continued. Even though only small amounts of chloroform are used, I have come to believe that it is not safe to continue the operation for more than half an hour, even though not more than from 3 to 8 minutes may be available for actual inspection. It may be that even less time than this should be placed as the limit.

In spite of the greatest care a certain amount of local traumatism will occur which may be the starting point of a fatal bronchopneumonia. Should hooks or other instruments become caught in any part of the air passages so that a little force is required to remove them, the lung is liable to be torn in such a way that the air will pass out, causing either an emphysema or a pneumo-thorax and pleurisy, either of which may prove fatal. Patients are known to have died soon after bronchoscopy from pneumo-thorax, emphysema, or pneumonia and other conditions; and if the operator is blind to the dangers it is natural to attribute these fatalities to the foreign body or to the anesthetic rather than to the operation. Pulmonary oedema has apparently been the cause of death in several cases, and oedema of the larynx has sometimes necessitated a sudden tracheotomy. Dangerous bronchitis has also occurred. The two deaths that I have already referred to from unexplainable causes have suggested to me also that danger may arise from electric shocks communicated to the patient through the instruments. In several operations I have received severe shocks myself, and in one I saw sparks, though small ones, passing from the light carrier to the bronchoscope, and thence the current must have passed through the patient.

When we consider the relation of the blood-vessels to the trachea and bronchi and the very short distance from the lumen of these tubes to the intracellular pulmonary tissue, we must realize that it would not be safe to tear or cut anything within the tracheobronchial tree unless we were absolutely sure that it would not open a way for air to pass out into the pleura, mediastinum or lung tissue.

Jackson found a mortality of 9.6 percent, but by eliminating six cases that he thought would probably have died without the operation, the mortality would have been 3.2 percent. This does not appear to me a sufficiently conservative analysis of the statistics; on the contrary, the chances are greatly in favor of the mortality being much larger than the 9.6 percent. Of the six cases that he

would eliminate, no one can be certain that any of them would have died without the operation, and we may be certain that some, probably a majority, of the fatal cases observed by others have never been reported.

Notwithstanding all of the dangers, I believe that this operation is of great value in many of the conditions that I have enumerated, though it should be done with extreme care and gentleness. It is indicated in nearly all cases in the presence of foreign bodies in the air passages. Many foreign bodies can be easily removed by tracheotomy, but it would be better to try bronchoscopy first, provided there were not severe dyspnoea, and in every case where the foreign body cannot be extracted by tracheotomy, bronchoscopy is surely indicated. In the other affections mentioned this operation is often indicated, but the conditions of the individual patient and the experience and good judgment of the laryngologist must determine what course should be adopted.

Esophagoscopy.—Those interested in the history of this operation I will refer to Jackson's monograph. The instruments that are employed are essentially the same as those for bronchoscopy, though the tubes are larger and many of them shorter, and occasionally they are made oval instead of round. The instruments for the removal of foreign bodies or neoplasms from the oesophagus would be the same as those employed in bronchoscopy.

Esophagoscopy is done much more satisfactorily and pleasantly when the patient is fasting than at any time within a few hours after a meal. It is better that the stomach should be entirely empty of food in order to minimize the retching and nausea and to avoid vomiting.

Cocaine with one of the suprarenaline products may be used as an anesthetic in a large number of these cases, but in children and sometimes even in older subjects, it is better that a general anesthetic be employed. Either chloroform or ether can be used, as we will not have to consider the effect of the anesthetic upon the lungs in esophagoscopy as we do in bronchoscopy.

The tubes that are employed for esophagoscopy may be about 25 percent larger than those that would be used for a similar patient in bronchoscopy. A large percentage of the diseases of the esophagus occur in the upper portion of this tube, and foreign bodies are most likely to lodge behind the cricoid cartilage or immediately below that point, so that comparatively short tubes are generally employed. The oval esophagoscope gives a larger field for inspection than the round, and according to the area exposed it is

introduced considerably more easily than the round instrument. In either case, an obturator is desirable unless the part to be examined is near the mouth of the esophagus.

From its mouth to about the level of the upper end of the sternum the esophagus is closed, the slit indicating its lumen being directed from side to side.

As the esophagoscope is passed gently the walls of the esophagus seen across the end of the tube present a mucous membrane, only a few shades deeper in color than the laryngo-pharynx. When the instrument has passed a little below the upper end of the sternum the esophagus is usually found to be an open tube that contracts and expands more or less with the respiratory movements. This tube continues open down to near the cardiac orifice of the stomach. In the adult it usually appears from 8 to 10 mm. in diameter.

To examine the whole length of the esophagus, an instrument 7 to 9 mm. in diameter by 45 cm. in length is needed for children, and one 10 to 13 mm. by 53 cm. for adults. For an examination of the inner walls of the stomach a tube 70 cm. in length will be required for adults. The internal lamp lights up the longer tubes much more satisfactorily than any of those worn on the forehead or fastened to the handle of the instrument.

Esophagoscopy is of value in the diagnosis of strictures, diverticula and malignant or other growths; however, the danger of rupturing the walls of the esophagus must always be borne in mind, because in these conditions they sometimes tear very easily and such a tear is likely to be quickly followed by a fatal pleurisy or mediastinitis.

The operation is of special service in the diagnosis and removal of foreign bodies or tumors from the esophagus. Sometimes in this operation the edematous mucous membrane rolls down over the foreign body so as to completely hide it, even though the esophagoscope may easily pass all the way down to the stomach; therefore, wherever possible a good radiograph should be taken before the operation is attempted. Some foreign bodies can be seen distinctly with the fluroscope, but even metals, where thin or light, may throw such a faint shadow that they may be easily overlooked. I recall one case in which the radiograph showed a very pronounced shadow from a metallic breastpin which a child had swallowed, whereas I could not get the shadow at all with the fluoroscope at first, although I finally made it out, but think I should have overlooked it entirely but for the radiograph. It should be remembered that coins or other flat foreign bodies in the esophagus

practically always have their flat surfaces antero-posteriorly. A knowledge of this fact aids the surgeon greatly in searching for them and in their removal. Failure to find a foreign body as large as a nickel in the esophagus by esophagoscopy should not convince the operator that it is not present, because the swollen mucous membrane is very likely to be crowded down over it in such a way as to hide it.

There can be no question but that this operation is by far the best for nearly all cases of foreign bodies in the esophagus, though if one is so large that it cannot be removed when discovered, it may be necessary to do esophagotomy; however, some objects of large size have been successfully cut and then removed in pieces by the aid of the esophagoscope, with much better results to the patient than would probably have attended an esophagotomy. Esophagotomy has a much larger percentage of mortality than operations through the esophagoscope, and therefore, whenever possible, a skillful laryngologist should be called upon to remove foreign bodies before resorting to esophagotomy. It is certain that most foreign bodies that become lodged in the esophagus can be removed with very slight danger to the patient by aid of the esophagoscope. Neoplasms that can be secured in a snare may commonly be safely removed in the same way; those that would require the use of cutting instruments must be handled with extreme care, and ordinarily they are not suitable for this operation. Strictures of the esophagus that could not be managed with ordinary bougies might sometimes be overcome with the aid of the esophagoscope, and, as diverticula are dependent upon strictures, it is probable that some of these might be greatly benefited through this procedure that could not otherwise be satisfactorily treated.

As an illustration of the difficulties and dangers attending bronchoscopy and as a contribution toward perfecting the operation and making it safer, I wish to place on record concise histories of two recent cases.

On the 14th of November, 1908, a girl three and one-half years of age was brought to the hospital with symptoms of some pulmonary trouble but no history of having inhaled a foreign body; however, a radiograph showed that there was a small nail in the air passages. A surgeon did tracheotomy and attempted to remove it. He felt the nail but was unable to extract it and finally it passed down out of reach. Before the operation the pulse was 128, temperature 98 and respiration 28; ten hours afterward the pulse was 144 irregular and intermittent and the temperature 104.6. The

next day the pulse, temperature and respiration continued high, but on the following day the pulse ranged from 128 to 160, the temperature 101 to 102.3 and respiration 60 to 72. On the succeeding day the pulse dropped to 120, the temperature to 100 and the respiration to 54. The fourth and fifth days the symptoms were better, but on the sixth day (the 20th of November) it is noted that there was pneumonia of the left lung, although the temperature was not much, if any, higher. I was then asked to attempt to remove the object by bronchoscopy, and at four p. m. on the 21st, the child was given chloroform and the operation made. A radiograph showed that the nail was at this time deep down in the left lung, and the operation demonstrated that it was in the bronchus going to the upper lobe. I searched with the greatest care for about an hour, examining the main stem of the left bronchus and its branches going to the lower lobe, but, probably on account of the swelling of the mucous membrane and the contraction of the bronchus, I was unable to see the opening of the bronchus going to the upper lobe and could not feel the nail. The operation was then abandoned with the intention of repeating it another day. Three hours later the pulse was 180 and weak, and the respiration over 90. At the end of four hours the pulse was 160, temperature 102.2 and respiration 84; four hours later the temperature was 103.2; the next forenoon the pulse was 160, temperature 102.6, respiration 88, but by noon, twenty hours after the operation, the pulse was 176, temperature 104.4, respiration 76. The conditions continued unfavorable and the patient died of pneumonia forty-eight hours after the operation.

In this case pneumonia was already present, though the symptoms were not marked at the time of the operation, and the bronchoscopy was done through a suppurating wound in the trachea. The patient's condition at the time of the operation, and possible carrying of the pus from the wound into the lung, undoubtedly contributed to the fatal result. How could the difficulty in seeing the bronchus going to the upper lobe of the lung have been overcome? Would it have been better to have delayed the operation until this patient had recovered, or died from the pneumonia? I await answers from others to both of these questions.

The second case.—A child seventeen months of age was brought to me on the 7th of January, 1909, with the following history:

Four weeks previously the child, while in perfect health, was playing with an older brother and both of them fell upon the floor. The patient was immediately seized with a severe paroxysm

of cough which nearly strangled it. The cough had continued ever since and there had been several paroxysms which the parents reported came near being fatal. An examination revealed a great many large and small mucous rales all over the chest, but no dullness and no disparity in the respiratory murmur on the two sides. A radiograph gave no shadow of a foreign body, but the history and signs made it practically certain that some foreign substance was in the air passages. At 4 o'clock the same afternoon chloroform was given, and I operated with extreme care. I gave neither opiate nor atropine, and I used a weak solution of cocaine with suprarenaline only two or three times in the larynx. The bronchoscope was introduced easily and quickly, and I made a most careful and gentle search of the trachea and bronchial tubes of both sides. Owing to the great quantity of secretion the operation was much prolonged, at least nine-tenths of the time being spent in pumping and wiping out the secretions. The child was taking very little chloroform and I thought no damage was being done. I designed to abandon the operation at the end of an hour, but the condition of the patient was so favorable and my anxiety to find the foreign body so great that I unconsciously kept up the search half an hour longer, but nothing could be found.

At the time of the operation, temperature per rectum was 101 and at midnight it was 105.4, pulse 122, respiration 140. The next noon conditions remained the same and much the same the following day, but during the afternoon of the third day after the operation the temperature and pulse fell to normal. The fourth day the temperature went once to 103; the fifth to 100.8, and the sixth to 102.3; afterward there was steady improvement for three or four days, but subsequently the temperature daily ranged from normal up to one or two degrees higher for four weeks. The nurse said that the child had occasional paroxysms of dyspnoea during the night for three or four nights, but the bronchial rales greatly diminished, although the physical signs showed a slowly resolving pneumonia of the lower lobe of the right lung. When the temperature first went up the interne reported a broncho-pneumonia and I ordered 1/200 gr. of strychnia and 1/2 drachm of liq. and amm. acit. every three hours, and the chest was covered with an oiled silk and cotton jacket. This treatment was continued until the immediate danger was passed.

Since writing the foregoing, or a month after the first bronchoscopy on this patient, after consultation with several of my colleagues I decided to operate again.

The extreme dullness over the lower lobe of the right lung, with absence of breath sounds; the outline of the dullness and the negative results of several exploratory punctures suggested obstruction of the bronchus going to that portion of the lung with collapse, and eliminated the diagnosis of pleurisy. The patient's temperature had been running up to 102 or 103° F. about every third day for two or three weeks, which pointed strongly to sepsis.

At four p. m., February 8th, when the patient was sent to the operating room the rectal temperature was 102.7° F. Morph. sulph. gr. 1/50 and atrophin sulph. gr. 1/500 had been given hypodermatically. Chloroform narcosis. Bronchi of right lung thoroughly explored down to a calibre of 3 mm. with negative results. Examination lasted fifteen minutes. Patient removed to ward and temperature found to be more than a degree lower. Patient placed in croup tent, air of which was kept very warm and moist, for forty-eight hours. By midnight the temperature was normal, and the next day it was only 99.2 and patient was in excellent condition. The danger in this case seems to have been avoided by the short operation and the warm, moist atmosphere.

How could the difficulty due to excessive secretion have been avoided? Possibly by the administration of atropin in one or two full doses for a child of this size and age.

How could the unfavorable after-results have been prevented? In this case unfavorable symptoms followed the bronchoscopy promptly and the patient certainly was near death.

I incline to the belief that unfavorable symptoms after bronchoscopy are largely due to the mechanical irritation of the instrument.

As I have already pointed out, the bronchi, and the trachea in young children, expand and contract greatly with each respiration, and (as I clearly demonstrated in a child five and one-half years of age from whose right lung I removed a baby's "beauty pin" on January 13th, 1909) the bronchi are lifted and depressed fully a centimeter with each respiratory movement. From these movements there is constant respiratory stretching and pulling of the air tube over the end of the bronchoscope which would cause much of the mechanical irritation. This mucous membrane is not intended to bear anything like as much mechanical irritation as the conjunctiva, therefore it seems natural that the mere presence of the bronchoscope, even without pressure and stretching of the bronchi, would cause a great deal of irritation.

In order to avoid the dangers it appears to me that we must make the operation as short as possible; we must not touch any part of the tracheo-bronchial tract that can be avoided, and we should use bronchoscope as small as will give sufficient illumination and allow of the use of suitable instruments. The Killian tubes, 6-7 mm. in diameter for children over a year of age and 7-9 mm. for adults, appear to me the best. Foreign bodies in the lower part of the trachea might often be removed with a bronchoscope that only passed 1 or 2 cm. below the glottis, and foreign bodies in the bronchi may frequently be removed without passing the bronchoscope more than 5 to 10 mm. into the bronchus, providing we use forceps that will not catch the mucous membrane on the walls of the air passages and providing also that we are careful to open the blades in such a direction that we would not catch the tissue at the point of division of the air tube. In the trachea there would be no danger if the blades opened antero-posteriorly, for then they could not grasp the septum that runs antero-posteriorly between the two main bronchi at the bifurcation, and in the main bronchi it would be safe if the blades opened along a plane running from before downward and backward at an angle of about 20° to the mesian antero-posterior plane of the thorax, for they could not catch the tissues between the main bronchus and its first branch. Again, by using such forceps in this way the foreign body could often be safely and quickly removed from a main bronchus without taking time to remove the secretions so as to actually see the foreign body. Before the days of bronchoscopy I several times removed foreign bodies from the main bronchi with bent tube forceps inserted through a tracheal opening. In the case just referred to, by upper bronchoscopy, I removed the pin quickly in this way without cleaning out the secretions after having searched for it about seven and one-half minutes, the whole operation requiring but eight and one-half minutes. There were no unfavorable symptoms afterward. The difficulties of esophagoscopy are slight, as compared with bronchoscopy, but one must remember that the swollen and edematous mucous membrane may roll over and completely hide quite large foreign bodies, even though the instrument may pass without obstruction to the stomach. The dangers of esophagoscopy are much less because the mucous membrane is designed for the passage of foreign bodies and therefore will not be much irritated by the instrument.

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THE PRACTICALITY OF BRONCHOSCOPY AND ESOPHAGOSCOPY.

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There exists a great deal of incredulity on the part of those who have not practiced bronchoscopy and esophagoscopy as to the practical utility of these measures. It seems incredible to one who has not seen the operation, that a rigid metal tube, eighteen to twenty-four inches long, and a quarter to a third of an inch in diameter, can be passed through the mouth into the bronchus and its small subdivisions, to almost the very bottom of the lung, without wounding and tearing the lung and seriously endangering the life of the patient.

When I first saw Kilian examine the bronchus with the bronschoscope, my feeling was one of awe and great admiration of his courage and skill, but I think I admired most his courage. Jefferson Faulder expresses it well when he says that "When a man sees for the first time a bronchoscopic examination he is astonished. When he practices it for himself, he is still astonished. After acquiring some degree of skill he is surprised that bronchoscopy has made so little headway."

While it is nearly twelve years since Killian did his first bronchoscopy, and laryngologists the world over have been more or less familiar with the fact that he was doing this work, it is only now that the profession seems to be awakening to the great field of usefulness and the possibilities that exist in endoscopy of the bronchial and esophageal tracts and of the stomach. This slowness on the part of laryngologists in learning how to practice bronchoscopy and esophagoscopy has come about largely because its field of usefulness was supposed to lie almost exclusively in the removal of foreign bodies. The inherent technical difficulties have appeared much greater than they really are, and have doubtless deterred many men from attempting to acquire the requisite skill. It is not possible to acquire this skill without a great deal of practice, but the results well repay the effort.

Direct laryngoscopy was discovered by Kirstein, then direct tracheoscopy and bronchoscopy and esophagoscopy were developed by Killian, and later gastroscopy by Jackson. The next stage will be gastro-enteroscopy, a thing which is possible and will be, in some cases, of great diagnostic value, and will even make possible dila-

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tation of pyloric stricture by bougies. The writer on one occasion, while examining the stomach, came to the pylorus and was able to see through the opening into the gut for a distance of more than an inch, and could have passed the gastroscope into the intestine without any difficulty, had he at that time had the courage and a little more experience in gastroscopy.

Exclusive of direct examination of the larynx with the separable spatula made in the office for simple diagnostic purposes, under cocaine, I have made thirty-one direct examinations of the larynx trachea, bronchus, esophagus and stomach, for various purposes of diagnosis and treatment. Fourteen of these cases were reported in detail in a paper read before the American Laryngological Association, May, 1908, and publishd last August.[1] Brief reference will be made to some of these cases, as well as to the more recent ones, to illustrate my subject, the "Practicality of Bronchoscopy and Esophagoscopy."

Eighteen cases were examined under ether, thirteen under cocaine. The age of the patients ranged from a new-born infant an hour old, to one patient seventy-six years of age. Eleven were children under ten years, seven being under six, while twenty cases were adults. Twenty-one were for diagnosis and surgical treatment, and ten were foreign-body cases. There were no deaths or untoward results attributable to the operation. Three were direct laryngoscopies, twice for removal of papilloma of the vocal cords, once for foreign body. In two cases, papilloma of the laryngopharynx were removed through the tube spatula.

ESOPHAGOSCOPY.

Of the ten examinations of the esophagus, five were for foreign bodies suspected or actually present, and five for diagnosis of esophageal obstruction.

My first examination of the esophagus was made to remove a penny from the cardiac end of the esophagus in a child five years of age, in whom a supposed congenital stricture of the esophagus had caused his constant regurgitation of food and almost starvation since infancy. The X-ray showed the presence of the coin at the cardia. Under esophagoscopy it was found that the penny was encysted in the posterior esophageal wall and was revealed only after curetting this wall through the tube. The penny was then extracted.

In three cases of suspected foreign body in the gullet, an examination was made but the foreign body was not found, it having evidently passed on into the stomach, leaving only the sensation

as of a foreign body; a very common condition, but one that leaves the patient and physician in an uncertain frame of mind unless the fact can actually be demonstrated that no foreign body is present. These three cases were in adults, the foreign body complained of being a pin, fish-bone, and a spicula of bone, and all symptoms soon disappeared after the examination. In another case of foreign body, a piece of oyster shell, the shell was found at the upper end of the gullet, but it was dislodged by the instrument and disappeared before the forceps grasped it, entering the stomach and causing no further trouble. Foreign bodies most frequently lodge at the upper end of the esophagus behind the cricoid, and their retention there is doubtless aided by a spasmodic muscular contraction produced by the presence and irritation of the foreign body. It is not always the size of the intruder that determines the stoppage and lodging of the foreign substance, the sharp angles and edges that irritate, producing a spasmodic contraction.

On the application of cocaine locally or of general anesthesia the spasm relaxes and the foreign body may be released and pass on. This would be aided, of course, by the contact of the esophagoscope, so that unless the foreign body is actually wedged, or has penetrated the soft parts, it may quickly disappear and pass on to the stomach before forceps or other instruments can grasp it. This was shown beautifully in one case where a boy of six years had swallowed a tin whistle considerably larger than a quarter of a dollar, twenty-four hours before I saw him. An X-ray showed the whistle at the upper end of the esophagus. Under ether the esophagoscope was carefully passed and the edge of the whistle appeared. As soon as the forcep blades grasped the edge, they slipped off, and the whistle immediately disappeared. I followed it down into the stomach, which it readily entered, and disappeared from view. I soon rediscovered it, however, in the stomach and grasped it several times with the forceps, but the bevelled and slippery metallic edge prevented its being held. A hook passed into the central opening would probably have caught and held it, but I concluded not to try to bring it back through the cardia and esophagus, running the risk of tearing these parts, unless it should not in the course of a couple of days pass by rectum. This it did in thirty-six hours.

Five esophagoscopies were done for diagnostic purposes. All were made under ether and were entirely satisfactory, revealing the stricture in each case and clearing up the diagnosis. In a young man of thirty-two, the obstruction was due to a new growth, a sec-

tion of which was removed for microscopic examination by cutting forceps, and proved to be a carcinoma; in one case, a woman of seventy, a large diverticulem with a very small tight stricture, through which small bougies were passed, was discovered. In one case the cause of the stricture was a tertiary ulcer. One was a case of spasmodic stricture, the passage of the esophagoscope however, relieving her of all obstruction without any subsequent recurrence in more than a year. Another most interesting case was that of a woman of sixty-five years, with a history of progressive esophageal obstruction for six months. At the time of examination she had reached a point where even fluids did not pass, though two weeks earlier her physician had on two occasions passed a stomach tube. The esophagoscope revealed a narrowing of the gullet ten inches from the teeth, preventing the further passage of the instrument. The mucous membrane was a deep red color, but smooth. The posterior wall of the lower pharynx seemed swollen or infiltrated. Two days later the swelling of the lower posterior pharyngeal wall was distinctly soft and fluctuating. Under cocaine a free incision was made into this, and at least a pint of stinking greenish pus was evacuated. A curved uterine sound was passed into the wound and entered a cavity eight inches in length and posterior to and parallel with the esophagus, evidently a retro-esophageal or mediastinal abscess, possibly caused originally by a foreign body. The cavity was lined with a pyogenic membrane. The patient improved for two weeks, but at the end of four weeks developed a septic pneumonia and died.

In my earlier experience I was fearful of examining the esophagus, excepting under general anesthesia, but have learned that if the lower pharynx be well anesthetized with 10 percent. solution of cocaine, the esophagoscope can be readily passed without much retching or discomfort. Within the past six weeks I have examined the esophagus of two men in the office, aged fifty and seventy years, using cocaine, one of the patients in the sitting position, the other on the table, and neither of them much disturbed by the manipulation.

GASTROSCOPY.

There were six gastroscopies, four times for diagnosis, revealing ulcers and old scars and localized hyperemias distinctly seen, with topical applications of argyrol to some of them. In two cases foreign bodies had passed into the stomach from the esophagus, one being the tin whistle previously referred to. The other was a

penny swallowed by a two-year-old child and lodged in the gullet as shown by the radiograph. After reaching the operating-room the mother said the child had begun to act and swallow naturally a couple of hours before. The examination, however, was made, but the penny was not discovered either in the esophagus or stomach. It passed two days later by rectum.

BRONCHOSCOPY.

Of the thirty-one cases, nine were bronchoscopies, eight upper and two lower. Three were for foreign bodies, one being a duck-bone lodged in the second subdivision of the right middle bronchus and removed by upper bronschoscopy, one a fish-bone lodged for three weeks in the trachea of an eight-months infant, and removed by lower tracheoscopy.

The third case was examined several months ago and was that of the seven-year-old child of a physician in a neighboring city, who was brought to me six months ago. This child gave a history of a persistent spasmodic cough, which dated back to six months and followed a sudden attack of dyspnoea while eating popcorn. The physical signs in the chest were negative, but from the history of the case, a foreign body, probably a piece of popcorn in a bronchus or bronchiole, was diagnosed, and bronschoscopy advised. This was done under ether. Unfortunately, the foreign body was not discovered. The next day and for the following five days, while in the hospital, her old cough quite disappeared and we felt that the foreign body had possibly been dislodged and probably removed on the gauze sponges introduced into the bronchus to mop the secretions, and had been overlooked. Within a week, however, the cough returned, though with less severity and persistence. Three weeks ago her father wrote that the child had a few days previously coughed up the foreign body, which proved to be a piece of popcorn.

Upper bronchoscopy was done six times for purposes of diagnosis and treatment,—three for diagnosis of bronchial dyspnoea and three times for treatment of syphilitic ulceration revealed by the bronchoscope in a previous examination.

The remaining cases were, one for diagnosis proving the case to be an angio-neurotic edema of the bronchus, the other a compression of the trachea and bronchi by enlarged thyroid and thymus glands.

Briefly, these thirty-one cases covered a fairly wide variety of conditions. Foreign bodies were removed, under the guidance of

the eye, from the trachea, bronchus and esophagus, and seen in the stomach. Under any other method than the one under consideration, these patients would have been subjected to the danger of groping in the dark with dangerous instruments, or bronchotomy and esophagotomy would have been required with the chances in favor of the foreign body not being found and of the patient dying from the operation.

Hunting for a foreign body in the bronchus with the bronchoscope is at times a most difficult task and may result unsuccessfully. If the foreign body be sufficiently small, it may be drawn down into any one of a hundred small bronchioles in either lung, consequently a small foreign body might be looked for several hours and even then not found. The search in the absence of any definite localizing signs, such as an X-ray picture, a localized pain, rales, dullness, or sensation on the part of the patient, should be made systematically, beginning with the right main bronchus and following up the various subdivisions. Lower bronchoscopy, i. e., through a tracheal opening, is the operation by preference when the foreign body is a soft object like a bean, likely to break into pieces while being abstracted, or a body so large or ragged that the removal between the cords might be impossible or very dangerous to the cords. In infants and young children, Killian urges its preference. One should always be prepared for immediate tracheotomy, especially in children, while doing upper bronchoscopy. A foreign body in the esophagus should be found with the esophagoscope before any attempt at removal or pushing it into the stomach is made. The body should be located, its size and nature determined with the eye, and the decision as to the method of removal decided upon. It might be best to grasp it at once with the tube forceps and remove it along with the esophagoscope, or it might be necessary to reduce the body in size, as Killian did, in a case of a large vulcanite tooth-plate, removing it in pieces, or again it might be impossible to remove it by drawing it upward without risking tearing the esophagus and producing a fatal mediastinitis or abscess. An esophagotomy might be necessary.

The greatest and broadest field of usefulness of these endoscopic tubes lies, however, not in the finding and removal of foreign bodies, but in the diagnosis and treatment of diseases affecting the lower respiratory and upper digestive tracts. One of my examinations revealed cicatricial stricture and syphilitic ulcer of the bronchi, clearing up a diagnosis of bronchial dyspnoea, revealing a condi-

tion not previously suspected, allowing also local applications to the bronchial ulcer. In a new-born babe, blue as indigo, born but an hour, the laryngoscopic tube spatula revealed a perfect picture of the larynx and demonstrated a tracheal narrowing by an enlarged thyroid gland, and when this obstruction was relieved by an intubation tube and a soft rubber catheter, the dyspnoea still continued. The child only a few hours old, kept alive only as the father inflated its lungs or as we relieved the dyspnoea by passing a long canula in the bronchus, was in no condition to withstand such an operation as thymectomy or thyroidectomy or even tracheotomy through the enormous thyroid gland, and it died nineteen hours after birth. An autopsy confirmed the presence of a large thymus compressing the bronchi and a large goitre pressing on the trachea. This case, reported in full in my paper previously referred to, is of remarkable interest and shows the tolerance of the respiratory tract to examination and instrumental manipulation.

In the case of a young girl of fifteen years, with typical attacks of suddenly arising bronchial dyspnoea, often seemingly about to be fatal, and existing at intervals for ten years, it was thought wise to make a bronchoscopic examination to determine if possible any local bronchial condition that might be responsible for the trouble. Nothing local was discovered beyond a perfectly apparent swollen, pale, and edematous condition of the whole bronchial mucous membrane. It was a case of angio-neurotic oedema of the bronchus. Following the examination there was less dyspnoea, and fewer rales than before, and she showed absolutely no ill effects of the introduction of the bronchiscope, a thing of which I was very fearful before undertaking it.

In diseases of the esophagus, obstruction in swallowing is the leading symptom, sometimes the only one. This may be produced by a variety of conditions, e. g., spasmodic and organic strictures, new growth in the esophagus or external to it, aneurism, unsuspected foreign body, etc. The only instrument heretofore available in helping arrive at a diagnosis was the bougie. That could determine only the fact and the locality of a stricture, a thing already pretty certainly known from the history of obstruction. Now with the esophagoscope we can actually see the stricture, its probable nature, can remove a section of a new growth for microscopic examination and arrive at a diagnosis that is likely to be correct. If a small ulcer be present, it can be treated locally, and so relieve the spasmodic stricture; if organic, it can be dilated with

safety, and sometimes one passage of the esophagoscope will relieve a stricture of the gullet of many years' duration.

Both bronchoscopy and esophagoscopy can be done under cocaine anesthesia; and as my experience and confidence increased, I found there was not the need of a general anesthetic as often as I at first supposed. In children, general anesthesia will be necessary, as it will be in very nervous adults. As we ourselves increase in proficiency of manipulation, fewer of these nervous adults will require to be put under a general anesthetic.

For stomach examinations a general anesthetic is probably always indicated because the stomach does not tolerate with safety the examination that is required, and the consequent retching or vomiting would be very dangerous.

General surgeons and physicians, as well as the great majority of laryngologists, are apparently still to a great extent unaware of the fact that the trachea and the bronchial tree, down to the third subdivision of the bronchus, are as open to ocular inspection as is the interior of the nose through the nasal speculum, or the larynx with the laryngeal mirror. I am confident that I have seen the bronchial mucous membrane, the bronchial bifurcations and divisions, down to the small bronchioles, as clearly, yes, more clearly, than I have ever seen the nasal mucous membrane and the turbinate bodies in the nose with reflected light as usually seen. The esophagus can be examined from its pharyngeal to its cardiac end with as great minuteness, and as clear observation of the condition made, as can the larynx in our usual method of laryngoscopic examination. Not, it is true, with as great ease, but with as great thoroughness. Either will, at times, fail to be satisfactory. It is possible to examine the gastric mucosa in the greater part of its extent, obtaining as accurate information of the mucous membrane of that organ, as we very often obtain of the naso-pharynx when we examine the latter organ with the post-nasal mirror. It is certainly much more difficult, and requires much longer time, to examine the stomach than it does to examine the naso-pharynx; but granted that we want the information and are willing to make the effort necessary to obtain it, then I say we can often obtain as accurate information, by the eye, of the condition of the stomach, as we frequently do of the naso-pharynx. We do not always get a satisfactory view of the naso-pharynx; we have often to be content with a momentary glimpse of a very small part of it; in some patients we never can obtain any kind of a view of this region, because of the retching and gagging which some patients cannot overcome. So it is and

will be in examining the stomach: many will be examined satisfactorily; in a minority the result will be unsatisfactory. Then, again, we have all of us examined thousands of noses, thousands of throats, and are all more or less familiar with the varying conditions of health and disease of these familiar organs and can from long familiarity, in the great majority of cases, read their condition aright. We are now, however, when we come to examine the living bronchus, esophagus and stomach, dealing with new territory. We must acquire practice and technique in the handling of the instruments; we must see cases sufficiently often to become familiar, not alone with the appearance of abnormal conditions, but with normal ones as well.

Many practical difficulties are met with in making these various examinations. The secretions in the bronchi may be very profuse, requiring constant mopping; there may be difficulty in keeping the esophagoscope and gastroscope free of stomach contents, fluids, mucus, etc. The suction pump has to be kept going, sometimes almost constantly. In some cases there is difficulty with the anesthetic. In others the greatest trouble is with the use of the gag and the holding of the epiglottis forward and the larynx open. In one case it was almost mechanically impossible to get the tube into the trachea because of the prominent upper incisor teeth, and seemingly a partial ankylosis of the jaw, preventing the wide opening of the mouth.

The tubes are necessarily long, rather difficult to prepare and sterilize; the forceps are slender and easily broken; the cotton and gauze carriers have to be constantly changed and care taken that the gauze is sufficiently fastened to prevent its dropping off in a bronchus, the electric current and small lamps produce troubles of their own at inopportune moments. The intense straining of the eye to see as it looks down the long tube is very tiring. In many cases the work is most laborious and exhausting, especially in cases where general anesthesia is employed. Often two and three hours are occupied with a single case. Every moment is one of concentrated care and anxiety. But nothwithstanding all this, when the foreign body is found and removed, when the diagnosis of the diseased condition is made clear or perhaps the local treatment made, all the difficulties, none of which are insuperable, are forgotten, and in its place there is a satisfying sense of something accomplished which could not have been done in any other way, some tangible and important result obtained.

No. 831 University Block.

THE PHARYNGOSCOPE, A NEW ELECTRICAL INSTRUMENT FOR EXAMINATION OF THE PHARYNX, POSTERIOR NARES, EUSTACHIAN TUBES AND LARYNX.*

BY HAROLD HAYS, A. M., M. D., NEW YORK CITY.

The first model of the pharyngoscope which I devised was presented to the Otological Section of the Academy on April 9th. Since then, numerous modifications of the original instrument have been made with the kind assistance of Mr. R. Wappler, which have brought it to as near a state of perfection as possible.

Before describing the pharyngoscope, I shall take a few moments to repeat some of the remarks formerly made.[2]

An exact study of the anatomy and pathology of the postnasal space has been hampered heretofore by the lack of suitable instruments for such an examination. In the hands of the expert rhinologist and laryngologist, a definite diagnosis can frequently be made of various pathological conditions in the postnasal space but a close study of the parts has been impossible, particularly in those individuals whose throats are at all sensitive. Moreover, a symmetrical picture of the two sides of the nasopharynx has seldom been seen even by the expert observer. Granting that the posterior nares are readily seen in the patient with a large nasopharynx, the best evidence that the Eustachian tubes have not been so closely studied, is that the pathology of Eustachian tube conditions is very meager. Moreover, with the mirrors now used, one must place the patient in the upright position and instruction must be given as to how to use the throat during an examination. Examinations of unconscious patients or patients in the recumbent position, have never been successfully performed.

The pharyngoscope eliminates many of the difficulties frequently encountered. When the instrument is once placed in the proper position, under ordinary circumstances, the observer can usually pursue an investigation of the postnasal space and larynx lasting from five to twenty minutes, without ever changing the position of the instrument and with the throat muscles relaxed.

* Presented at the Metropolitan Medical Society, April 27, and at the Laryngological Section of the New York Academy of Medicine, April 28, 1909.

(2.) New York Medical Journal, April 17, 1909. Americal Journal of Surgery, May, 1909.

Many attempts have already been made, particularly since the advent of electricity in the field of surgical diagnosis, to get a better view of the pharyngeal vault and adjacent parts, and now that the laryngoscopes of Killian and Chevalier Jackson are so universally used, the direct view of the larynx is comparatively easy. The glass electric tongue depressor inserted behind the uvula, used in connection with the rhinoscopic mirror, gives a fair view of a small part of the postnasal space. The salpingoscope, used through the

Figure 1. The Hays' Pharyngoscope

nose, has limited advantages. Theoretically a close study of the Eustachian tube, may be made with this instrument but in the majority of cases, the lens becomes covered with mucous and therefore the view is obscured. Attempts have been made to examine the postnasal space with the cystoscope but the lamps were not properly placed and the circular form of the instrument made it difficult to hold it firmly on the tongue.

The latest model of the pharyngoscope is composed of a horizontal and a vertical shaft, joined at the outer third so that the instrument may be used as a tongue depressor, (see Fig. 1). The

horizontal portion is about eight inches long and less than five-eighths of an inch at its widest part. The inner two-thirds is flat, containing a central tube into which fits a telescope (somewhat like the cystoscope) and two wire carriers. The two lamps, placed at the inner end, on either side of the central tube, are powerful and water-tight. They can be attached to any rheostat or to a dry cell battery. The telescope is removable from the central tube and can be inserted until the lens reaches beyond the lamps and can be rotated through a circle of 360 degrees. A small metal ball on the eye-piece indicates the position of the lens.

The vertical shaft can be unscrewed from the horizontal part. It contains the wires for attachment to the rheostat. A device for turning on or cutting off the electric current is placed near the upper pole.

The instrument cannot be sterilized by boiling but like the cystoscope, it is best disinfected by formalin fumes. For that purpose, a metal box, large enough to contain all of the horizontal shaft of the

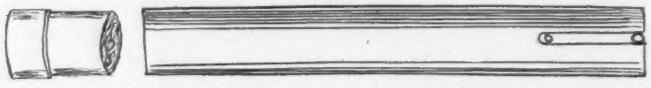


Figure 2. The metallic box in which the Pharyngoscope is carried. The formalin container is shown.

instrument but the eye-piece, is supplied, at the base of which is a receptacle for formalin tablets and cotton (Fig. 2). For dispensary use, the instrument should be immersed in lysol, five per cent carbolic acid or alcohol.

The pharyngoscope is used like a tongue depressor. The patient is told to open his mouth and breathe quietly. The instrument is placed firmly on the tongue until the end of the telescope is about one-sixteenth of an inch from the pharyngeal wall (Fig. 3). The patient is then told to *close his mouth and breathe through the nose* (Fig. 4). The muscles are thus relaxed and the pharyngeal space much enlarged. The picture presented is plainly seen by looking through the eye-piece of the instrument. A large mica plate which fits on the telescope is supplied, which eliminates the discomforture of having the patient breathe in the examiner's face.

When the lens is pointing directly upward (as indicated by the ball on the eye-piece), a distinct view of the pharyngeal vault is obtained. By turning the lens slightly to either side, the Eustachian tubes come into view. By tilting the instrument, the posterior nares, somewhat foreshortened, appear. By turning the lens down,

the larynx is plainly seen. If the patient is told to inspire deeply, the epiglottis is raised and a much clearer and larger view of the larynx is obtained.

I have thus far examined about one hundred and fifty cases with the pharyngoscope and in the majority of instances particularly with office patients, I have found the examinations comparatively easy. The usual gagging and retching does not occur very often especially if one becomes an expert in the use of the instrument. I have

Figure 3. First position in inserting the instrument.

been able to keep the instrument in position for from one to thirty minutes without any inconvenience to the patient. A tabulation of some fifty cases shows that cocain was needed in but eight instances (mainly dispensary cases), that only four cases were difficult to examine, that slight retching occurred in nine cases, that the posterior nares were seen in forty-five cases, the pharyngeal vault in forty-seven cases, that the Eustachian tubes were seen forty-five times out of forty-eight cases examined, and a view of the larynx, in part or the whole in every instance.

As I have been using the instrument for only a short time, it will be possible to give merely an incomplete report of the pathological conditions seen. Various pathological conditions of the Eustachian tube have been differentiated, i. e., congestion, lymphoid

hypertrophy at the mouth of the tube, adenoid tissue obstruction, obstruction due to mucus, stricture, hypertrophy of tissue of the Eustachian eminence, etc. An interesting observation has been made by passing the Eustachian catheter through the nose and attempting to place it into the tube by inspecting the parts with the pharyngoscope. It has been found that in certain cases a ridge is encountered in the fossa of Rosenmueller which feels like the Eustachian eminence. An attempt at catheterization in such instances, is nil. Under the eye the tip of the catheter can be placed directly into the tube without difficulty (Fig. 5).

Figure 4. Pharyngoscope in place with mouth closed.

For the diagnosis of conditions of the pharyngeal vault the instrument is ideal. Adenoid tissue can be studied closely. An example of such an advantage is well shown by the following case. A young girl came to the New York Eye and Ear Infirmary suffering from chronic middle ear suppuration. The tonsils had been removed. Adenoids had not been found. Examination with the pharyngoscope showed a large adenoid (Fig 6), almost entirely obstructing the posterior nares and Eustachian tubes. The illustration was drawn with the adenoid in situ. Not only could the various lobes and lobules be seen but the amount of mucous secreted could be observed and the exact amount of nasal obstruction ascertained. Moreover, one could judge the size of the curette to use. Two days later, without relying on any further examination, I removed the adenoid in one piece as shown in Fig. 7. A contrary case was one sent to me for adenoid removal. The young man had been a "mouth breather" for years. Examination with the pharyngoscope showed a clear pharyngeal vault. It was found that the patient

on account of an extremely high arched palate and mouth breathing had become a habit. A common condition seen is a small adenoid could easily breathe through the nose, but the nares were narrow

Figure 5.

Figure 6.

Figure 7.

Figure 8.

Figure 5. Showing the Eustachian Catheter in the Right Eustachian Tube. (Drawn by Dr. Percy H. Fridenberg).

Figure 6. Adenoids in Pharyngeal Vault, showing middle and lateral lobes. Both Eustachian Tubes covered. Only small part of posterior nares seen.

Figure 7. Exact reproduction of adenoid after removal. (Refer to Figure 6).

Figure 8. Small adenoid over upper portion of septum, commonly causing "catarrh" and thick tenacious mucus in the vault.

situated over the upper part of the septum which causes no obstruction but constant mucoid discharge (Fig. 8).

Many patients with and without laryngeal abnormalities have been examined. As was said before, in every instance a part or the whole of the larynx was seen. An overhanging epiglottis

sometimes obstructs the view. The base of the tongue and lingual tonsil appear magnified and the larynx itself small in proportion. However, the picture presented is much clearer than with the laryngeal mirror and in many cases as good as when seen by direct laryngoscopy. Cases of acute and chronic laryngitis, the latter with thickening of the false cords, paralysis of the arytenoids, tubercular laryngitis, a small tumor of the vocal cord, etc., have been clearly seen. Figure 9 shows the view of the normal larynx and Figure 10 is a case of arytenoid paralysis.

Figure 9.

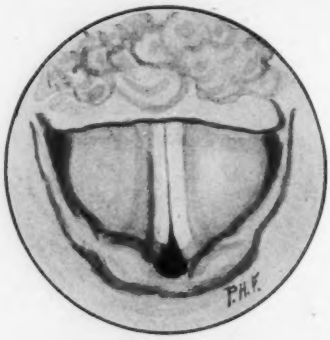


Figure 10.

Figure 9. The larynx with cords abducted. Note the apparent hypertrophy of the lingual tonsil.

Figure 10. Paralysis of the arytenoideus muscles. Note the separation of the cords at the posterior commissure.

I am devising a separate attachment to the instrument which in all probability will allow us to catheterize the Eustachian tubes directly through the mouth by means of small silk-woven catheters which will admit of minimum traumatism to the Eustachian tubes. If a sterile catheter can be passed into the tube through a sterile instrument after the nose and throat have been cleaned, we shall be able to treat middle ear conditions with much less danger of infection.

The instrument is made by Mr. R. Wappler of the American Cystoscope Makers, Inc., and is sold by the Wappler Electric Controller Company of this city.

I wish to take advantage of this opportunity to thank Dr. Percy H. Fridenberg for the wash drawings which were made, either from sketches of my own, or from his original observations.

11 West 91st Street.

PHARYNGOSCOPIC STUDIES.*

BY PERCY FRIDENBERG, M. D., NEW YORK.

Among the advantages of the Hays instrument are that it allows of the routine examination of a large number of normal and pathological cases and thus gives us much needed data as to individual variations, besides producing the minimum of discomfort to the patient. In fact, with superficial cocainization of the uvula and pharyngeal wall, we can allow the instrument to remain in situ during a prolonged examination of the parts. After a few seconds the subject seems hardly aware of its presence. I consider this a valuable feature and one which will be of great service in the examination of the pharynx and larynx during such physiological acts as yawning, deglutition, or pathological movement complexes such as gagging, coughing, and so on. Some of these cannot possibly be studied by the usual indirect method of mirror laryngoscopy, as the mouth has to be held open and the mirror almost invariably interferes mechanically with some movements of the base of the tongue. Even where there is no actual pressure or even contact, the attention of the patient is concentrated on the hypothetical or expected interference with the automatic and natural coordination and sequence of muscular action. In a mechanism as finely organized as that of tone and speech production this must be a great impediment. Even the concentration of attention on the normal processes causes them to become unnatural and labored, losing the rapidity, ease, and rhythm of the reflex. Thus breathing grows labored and changes its rate when we try to count our own respirations. Locomotion changes its character and becomes rhythmic and accentuated when we study the movements and sensations in walking.

Aside from the advantage of being enabled to examine the pharynx, larynx, and post-nares through a closed mouth and during complicated physiological associated motion, there is the further very valuable aid afforded by a new viewpoint in the literal sense. We see the posterior pharyngeal wall, somewhat foreshortened, in its entire extent, and have presented to us the uvula and soft palate directly "end on." (Fig. 1). The plica triangularis and supra-tonsillar niche can be studied because of the direct view into their recesses, as in no other way. The action of the azygos uvulae in

gagging, (Fig. 2), is very striking. The tip of the uvula recedes and appears to become buried in its own stump, while the entire soft palate rises and becomes more tense.

Eustachian Tubes: There is much greater individual variation in the size and position of the two pillars of the tube, the folds known as plica saplingo-palatina and tubal torus, than the diagrammatic representations of the atlases would indicate. Studies of the post-nares during deglutition are interesting, especially when there are adenoid masses in the epipharynx. (Fig. 3). Even slight gagging causes a marked reduction of the post-nasal space by an approximation of the walls in parallelogram. The uvula and soft palate rise and straighten, there is some downward bulging of the

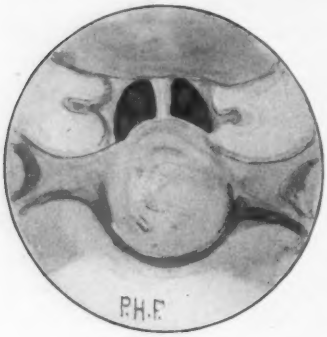


Figure 1.

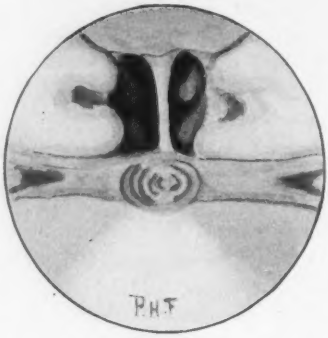


Figure 2.

Fig. 1. Uvula and soft palate, relaxed.
Fig. 2. Uvula and soft palate, contracted in gagging.

upper part of the posterior pharyngeal wall, and an advance toward the middle line of the entire tubal eminence and tori. As this becomes more pronounced, the opposing surfaces come into actual contact and one can see clearly how large masses of mucus are pressed out into the pharynx. Heretofore such studies were made only on the cadaver or, in rare cases of extreme destruction of the turbinate bodies, by anterior rhinoscopy.

The position of a catheter in the Eustachian orifice can be controlled with ease and the pharyngoscope will undoubtedly be an aid in demonstration and instruction in the procedure of catherization. It allows the manipulations by the student to be followed by the eye of the instructor and corrected when necessary; a most important and practical gain.

Adenoid Hypertrophies. Our conception of the location of these masses is made much more definite by the use of the pharyngoscope. In some cases we see, in addition to the large masses in the vault, covering the septum, or located in the fossae of Rosenmueller, a marked diffuse lymphoid nodular deposit on both tubal eminences and laterally in the recesses above the attachment of the soft palate. (Fig. 4).

Post-Nasal Discharge. By mirror examination which is necessarily intermittent and hardly more than momentary, requiring the insertion of a palate retractor, the source of secretions, suppuration, and so on, can at best be inferred. With the pharyngoscope in situ we are enabled to watch the effect of various head positions

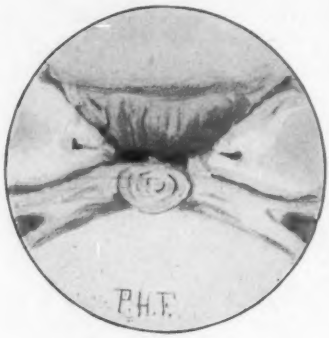


Figure 3.

Figure 4.

Fig. 3. Post-nasal space narrowed in gagging. Adenoid mass above.
Fig. 4. Adenoids. Large central mass. Lateral infiltrates in Rosenmueller's fossa and about tubal eminence.

or result of intra-nasal procedures and thus to trace to their source any fluid accumulations.

Hemostasis. In bleeding from a point far back in the nasal chambers we are enabled to locate the bleeding point or area with accuracy. This cannot fail to be of service in leading us to a correct therapeutic management of both spontaneous and post-operative hemorrhages in the upper respiratory tract and may make it possible in many a case to apply pressure or cautery directly instead of having recourse to a general compression as represented by plugging of the posterior nares with its attendant discomfort and dangers of middle-ear infection.

No. 60 East Fifty-eighth Street.

CEREBRAL AND EPIDURAL ABSCESSES OF OTITIC ORIGIN.*

BY GEORGE T. ROSS, M. D., D. C. L., (HON.), MONTREAL, CANADA.

Some degree of apology might consistently be offered for introducing so large a subject as Brain Abscess, to be discussed in the short time allotted to the reading of a paper, when I consider the fact that we might profitably occupy an entire evening in the consideration of its diagnosis alone, if we took up the matter *in extenso*. It must be, therefore, in a very superficial way that I shall refer to some of the salient features of this disease, or rather this sequel to disease, which is or should be of intense interest to every practitioner of the healing art, whether he or she be general or special.

To begin with, it is rather humiliating to admit, as we must, that notwithstanding all previous endeavors, it often happens brain abscess is first discovered at the autopsy. The causes of a mistaken or delayed diagnosis of a brain abscess of otitic origin are various. Every intracranial complication, which has its origin in a purulent otitis, may make its appearance in a sharply-defined and easily diagnosed picture. For certainty of diagnosis, however, a fully developed symptom complex is necessary. Many signs pointing to brain abscess may belong to a complicating meningitis. When we remember how intimately in the course of their development, the complications are intertwined, and how the signs of ear disease, functional nerve disturbances and other brain lesions, can closely simulate this condition, we realize the difficulties of diagnosis. So great a master as Schwartze was uncertain of a diagnosis which seemed to lie between an abscess of the temporal region and a meningitis. The autopsy proved it to be a cerebellar abscess. The variations and latent course of brain disease may make the diagnosis very difficult, indeed, sometimes impossible. A patient may have an acute or chronic inflammation of the ear, with no evidence of brain implication, and be discharged from treatment as cured; having only a slight headache perhaps, and feeling well enough, he resumes his ordinary occupation. In such a case cerebral abscess may develop; indeed, instances are on record where some couple of weeks after apparent convalescence the patient has suddenly died from brain abscess without previous evidence of its existence.

*Read before the Montreal Medico-Chirurgical Society, April 16, 1909.

On the other hand, such abscess may be latent for many years and long after its origin be excited to renewed activity.

A localized purulent focus within the brain tissue may be either acute or chronic. Acute cases are rare, while the most common cause of chronic cerebral abscess is purulent otitis. These abscesses may involve any region of the brain, may follow a simple inflammation within the tympanum with pus, by direct extension of the infection through the tegmen and dura, or may follow other avenues by veins and lymphatics; or pus in the mastoid may cause them; or, indeed, it is claimed and seems proved that a collection of pus in any part of the body may, through metastasis, cause the formation of a cerebral abscess. The locality most frequently affected through purulent otitis is the temporo-sphenoidal lobe, and the next in frequency the cerebellum. If it be located so that the increase in size causes pressure on the motor tract, or on the motor area of the cortex, then localizing symptoms ensue. When the abscess is chronic the increase in pressure develops so gradually that paralysis may occur without convulsions. In chronic cases a marked impairment of health may be the first sign of cerebral abscess. The temperature is seldom above 99° F., the pulse normal, subnormal, or intermittent. Headache is apt to be present and is dull or diffuse in character. Sometimes sleeplessness is the only symptom for which the patient seeks advice. Again you may have anorexia, irritability, sleepiness and a stuporose state gradually deepening into coma. It is well to remember that an otitis on one side may produce an abscess in the opposite hemisphere. Examination of the eyes is sometimes a useful aid, for optic neuritis is often present.

When there is pus between the dura mater and the osseous wall of the cranium, it is only necessary to perforate the skull in order to evacuate the fluid. The decision as to the exact location of an epidural abscess is sometimes a difficult matter, but experience has shown that the most usual location (Dench) for such abscesses has been either in the posterior cranial fossa, or the middle fossa. In emptying these abscesses it is unwise to remove the bone beyond the limits of the pocket of pus, for there is danger of breaking down the firm adhesions which protect the cranial cavity from the purulent collection. If a perisinus abscess is opened, it is most important to separate this cavity from the mastoid wound to prevent infection of the exposed dura, which might result in general purulent meningitis, and hence if the cavity be large the dressings may

require frequent changing. The results generally of operative treatment in simple epidural abscess are very favorable.

Apropos of these remarks I beg to report to the society a case wherein there occurred simultaneously one temporo-sphenoidal abscess, two epidural abscesses and one sub-periosteal abscess in the same patient, all of otitic origin, within a comparatively short time.

Mrs. M. entered the Western Hospital on the 28th of December last, complaining of pain and swelling behind the right ear, with occasional headaches. She was thirty-seven years old, the mother of eight children in ten years of married life, and was again pregnant. She had "pleurisy" two years ago and poor health ever since. At the beginning of November last the patient had a severe earache, lasting six to eight hours. Then a watery discharge came from the ear and lasted three weeks, after which it changed to pus and continued thus for a week or so longer, when it ceased. After the pus stopped a swelling started behind the same ear with great pain. This condition was maintained with more or less severity for about a month, when she sought relief at the hospital. Her father and sister died of tuberculosis sometime ago, otherwise the family history was negative. The patient's condition on entering the hospital was as follows: Behind the right ear over the mastoid a large area of swelling is seen. This area extends backwards from the auricle two inches, and from a horizontal tangent corresponding with the tip of the auricle, it extends downwards to the mastoid tip. It is red, oedematous and boggy, and has thickened the tissues throughout the region indicated, but especially over a portion of it, to thrice their normal state. This whole area is extremely sensitive on palpation and causes much suffering. There is a superficial sinus on the same side an eighth of an inch in diameter, undermining the cellular tissue, beginning at the digastric fossa and extending along the border of the sterno-mastoid muscle downwards five inches, which discharges some pus. In the external auditory canal the postero-superior wall is sagging, and largely obscuring the membrana tympani, which is whitish, owing to epithelial necrosis and exfoliation. A perforation exists in the posterior inferior quadrant, and a little pus is present. The patient's condition generally was most unsatisfactory, she being emaciated and greatly reduced in health, first by too frequent child-bearing and secondly by the almost constant suffering of the past six or eight weeks and to make matters worse she was again pregnant.

Operation.—After the usual preparation the patient was anesthetized, a free opening made in the drum membrane and the ordinary curvilinear incision behind the auricle. At right angles to this another incision was necessary across the swollen tissues. Considerable pus was evacuated below the periosteum. After cleansing this region I opened the tympanic antrum. The tegmen antri showed a slight superficial change in its condition, and did not give the ordinary resistance of healthy tissue. No pus was found, however, on curetting it. In the aditus, attic and hypo-tympanum the probe and curette communicated good resistance. The mastoid cells were then opened, including the tip of the process, pus being found everywhere as far as the inner table of the skull. An area of necrotic bone was encountered in the mastoid, directly behind the external auditory canal, and in curetting this away it led to the lateral sinus, the dura of which had to be exposed before reaching healthy bone. At this point a peri-sinus abscess was tapped, which contained about two teaspoonfuls of creamy pus. This was cleaned and drained, special packing being inserted to ward it from the generally infected mastoid cavity. From the antrum to the external auditory meatus the channel was found quite patent and free for drainage. The wound was therefore closed in the usual way, after inserting proper drains into it and the superficial sinus. The hospital laboratory reported staphylococcus infection. From the date of this operation the patient's temperature, pulse and general condition were practically normal for over two weeks, the wounds were healing satisfactorily, and for a time she gained strength. Maximum temperature, 98.8° F., pulse 72 to 80. On the 14th of January, however, a wave of temperature rose one and a half degrees for six hours, then subsided to normal for two days further, when a low septic state asserted itself, with headaches, some irritability and occasional emesis. A lumbar puncture showed the cerebro-spinal fluid clear, no turbidity or sediment, no meningococci or other bacteria, the specimen being practically normal. The hospital pathologist, Dr. Nicholls, reported that the blood corpuscles were normal in size, shape and number. The hemoglobin was 85 per cent. with, he thought, slight leucocytosis. Examination of the eyes did not give evidence of any pronounced meningeal trouble, neither was there any clinical evidence of sinus thrombosis. On the 27th of January, after consultation, a second operation was decided upon. On the morning of the 28th, just before this operation was begun, some new symptoms developed, and the hospital neurologist, Dr. Robins, reported as follows: The patient is semi-

stuporose for the first time, but can be roused to answer simple questions; there is external squint of right eye; the pupil in this eye is larger than the left, showing weakness of third nerve; at times a left-sided Babinski, not constant; left hemiplegia noticeable; deep reflexes all active; sensation normal as far as could be tested.

Second Operation.—Assisted by Drs. England and Kerry, the former mastoid wound was reopened. The granulations in the mastoid were found satisfactory, but this time the instrument passed through the tegmen antri into the floor of the middle cerebral fossa with hardly any resistance, and a quantity of thick pus was here released from an epidural abscess. A button of bone was then trephined through the squamous portion of the temporal and the dura exposed. This was opened and a trocar and canula inserted into the tempora-sphenoidal lobe directly inwards and downwards. On withdrawing the trocar a stream of very fluid pus followed, which measured about an ounce. On again examining the tympanic cavity the channel to the external meatus was found patent; drainage was then inserted into both abscesses, the wounds cleaned and dressed. The patient rallied well, and the result seemed promising for forty-eight hours. It was noted that the left Babinski had disappeared, there were fewer headaches, patient readily replied to questions and voluntary power was returning in the left arm and leg. However, on the third day a change occurred, collapse supervened and the patient succumbed. An autopsy was made on the brain only, and was as follows: A trephine opening was found in the squamous portion of the right temporal bone and evidence of a former mastoid operation. On the floor of the right middle cerebral fossa an operative opening was found 1 1-2 by 1 centimeter in size, leading to the tympanic antrum. A large abscess cavity was found in the right temporo-sphenoidal lobe of the brain, extending from almost the apex of the lobe backward to a point approximately opposite to the upper end of the fissure of Rolando. The cavity, which was empty, measured antero-posteriorly 6.5 centimeters and transversely 6 centimeters. The wall consisted of a zone of condensation, covered with detritus (an attempt at the formation of a pyogenic membrane) surrounded by a line of congestion. Towards the posterior part of the right island of Reil, above the posterior extremity of the cavity, was an area of incipient red softening, which involved to a slight extent the internal capsule on that side just before it reaches the crus. Above the center of this was a more definite area of red softening 7 millimeters in diameter. Anteriorly

this area of red softening was continuous with the abscess cavity. The right internal capsule and the tissues between it and the abscess showed well-marked yellow softening.

Conclusions.—Although no pus came from curetting the tegmen antri in the first operation, I think in the light of later events and in view of the known frequency of abscesses occurring in this region from purulent otitis, I would in future be disinclined to follow the custom and advice of those who, like Lambert Lack, say "in the majority of cases the mucous membrane, unless very extensively diseased, will soon become healthy when free drainage has been provided, and its removal by baring the bone only delays the cure and opens the way to spread infection." In the first operation no fistula was found leading to the middle fossa, nor any evidence of dehiscence in the petro-squamous suture, yet under similar conditions again I would enter the middle fossa if any suspicion of the tegmen presented itself, even in the absence of pronounced clinical signs. Should no pus be found after exposing the dura, it could be protected by frequent dressings. The occurrence of the temporo-sphenoidal abscess seemed the climax of this patient's many obstacles to health. Did this arise from the epidural focus of pus in the middle fossa? From the proximity of the two and the experience of others, it seems reasonable to suppose it did, but we know that such infection could have originated elsewhere; and, if elsewhere, then breaking down the tegmen would have availed nothing and been no barrier to the formation of the cerebral abscess. Finally, having opened two abscesses already, in the area where the intensity of the disease had manifestly expended itself, —viz., the mastoid subperiosteal abscess, and the abscess over the lateral sinus—and afforded good drainage, it was rational to conclude that the source of existing symptoms had been eradicated when these foci were eliminated. Although unfortunately the case had not a successful termination, it was, I think, both interesting and instructive, and as such I offer it to the society, feeling, as I do, that the tendency of the profession to report successful cases only, is too generally prevalent. For that matter the results of a so-called successful operation are not always lasting in these cases, for it repeatedly happens that one, two or four weeks after the pus is evacuated an unfavorable outcome supervenes.

No. 623 Dorchester Street, West.

BLACK HAIRY TONGUE—HYPERKERATOSIS LINGUAE.*

BY H. ARROWSMITH, M. D., BROOKLYN, N. Y.

The purpose of this communication is merely to place on record an instance of this rare and curious lesion,—not to attempt any detailed consideration of the subject other than to call attention to the symptoms, or more properly the lack of them, in the given case.

About the first of November, 1908, I was led to look at my own tongue by the persistent sensation, which had lasted for several days, of having a tooth-brush bristle, a mustache hair, or some similar substance in contact with its upper surface. This irritation impelled me to scrape it with my upper teeth and expectorate frequently, in the effort to dislodge the supposed foreign material.

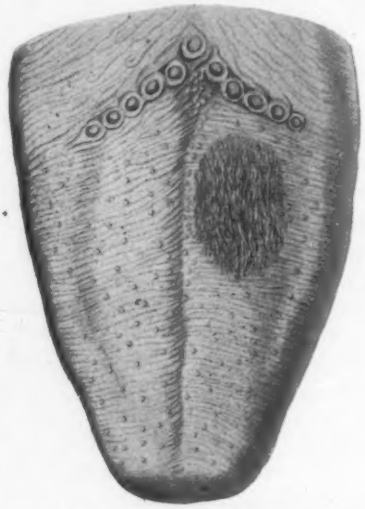
There was at no time the slightest pain or tenderness. Two-thirds of the distance from the tip to the circumvallate papillae, on the left side, was an area, ovoid in form, measuring about three-quarters by one-half an inch, slightly elevated and of a dark brown color. The surface of the tongue was otherwise entirely clean and normal in appearance. On stroking this area with a probe, the papillae were raised into a sort of crest such as is seen on the fur of a soft-haired animal after immersion. Some of the papillae were at least three-eighths of an inch in length. A number were cut off, en masse, with scissors, and submitted to Dr. Archibald Murray for examination. Dr. Murray reported as follows:

"The microscopic findings in the case of 'hairy tongue' are as follows: The tongue papillae are of the filiform variety; their length varies, I should say, between 8 and 10 mm. (normal length averages 0.7 to 3 mm.). Beside this great increase in length, the horny epithelium is seen to be largely augmented, the cells being piled one upon another. The connective tissue papillae are also increased in length and very slender. Some of their tips are seen to be denuded of epithelium. On the surface of the epithelium can be seen quite a large number of micro-organisms,—cocci and bacilli. Examined in the fresh state the papillae have a dark brownish color. The process evidently corresponds to a hyperkeratosis. A. MURRAY."

*Presented before the Section on Laryngology and Rhinology of the New York Academy of Medicine, February 24, 1909.

Within the next week, I demonstrated the lesion to a number of colleagues and hoped to exhibit myself to the Section on Laryngology toward the end of the month, but in about ten days the trouble had entirely disappeared and has since given no indication of any tendency to recur. Absolutely no treatment was instituted.

I was at the time in excellent physical condition,—am a pretty constant smoker and use alcohol occasionally. There is, as far as I know, no luetic taint and practically never any gastric or intestinal disturbance.



Blevgad, in Vol. XX. of Fraenkel's Archiv, has found in literature 138 cases, including ten of his own, which he describes exhaustively. His article was published in full in English in a recent number of *The Annals of Laryngology and Rhinology.* Apparently there have been reports of eight previous cases in this country.

There are a few points of interest on which he dwells. The etiology seems very vague,—syphilis and tobacco addiction have appeared in a number of cases, but not with sufficient constancy to be striking.

The duration has varied from two days to thirteen years. Treatment seems to be entirely without result.

No. 170 Clinton Street.

SOCIETY PROCEEDINGS.

NEW YORK ACADEMY OF MEDICINE.

SECTION ON LARYNGOLOGY AND RHINOLOGY.

Regular Meeting, April 28, 1909.

HARMON SMITH, M. D., Chairman.

PRESENTATION OF CASES.

Dyspnea Caused by Foreign Body in the Larynx, Treated by Direct Laryngoscopy. By T. J. HARRIS, M. D.

The patient, a man fifty-two years of age, presented himself for treatment a year ago last July, with the history that a short time previously he had swallowed part of a toothpick and ever since had felt it sticking in his throat, which finally gave him difficulty in breathing, though he had no trouble in swallowing. Laryngoscopic examination revealed nothing except a slight amount of excoriation on the posterior wall, so he was sent to the hospital and there subjected to direct examination under general anaesthesia. Exploration of the oesophagus and trachea down to the bronchi revealed no foreign body, though at the entrance to the trachea where the larynx and oesophagus meet, there seemed to be a small area of granulation tissue. The patient was allowed to come out from the ether and said that he felt better. In the course of a day or two, however, he complained of the same conditions, and from then on there was a hard fight to get him well. It was concluded that the toothpick had been lodged in the tissues, but had passed on, leaving this area of irritation, and that he was suffering from a paraesthesia. It was decided to go in and remove the area of granulation tissue. This was done and in the course of two or three weeks he recovered. On the first of September, he returned, saying that all the annoyance and pricking sensations had disappeared, that he now had no difficulty in resting, and regarded himself as well.

Last fall he reappeared in the office saying that two weeks previously he had a recurrence of all the former symptoms, that he was having great difficulty in breathing, and was sure he felt the toothpick in his throat. He was readmitted to the hospital, and again under general anaesthesia a careful examination was made,

but we found no toothpick in his throat and no evidence that there had been anything there, except that in the same area there seemed to be an unusual pathological condition to be referred to. Nothing was done, and the patient was allowed to come out from the anaesthesia, and again he recovered, which confirmed the opinion that it was a condition of hysteria. He left the hospital, and all there thought that he was faking. Dr. McCullagh had examined the case with Dr. Harris, and both felt that the man was certainly suffering with these attacks of dyspnoea and pain. On indirect examination the larynx seemed clear, but with Jackson's tube spatula, a very pronounced curtain could be seen which would flap back into the larynx and cover half of the larynx. Both Dr. Harris and Dr. McCullagh felt that this was sufficient to explain the dyspnoea, and under direct inspection, the tissue was removed as thoroughly as possible, though with some fear of a resulting oedema. There was considerable soreness afterward, but nothing more. The tissue was removed in two sittings. After that all the dyspnoea disappeared, and all the sensation of pricking of which he had complained last vear and the year before.

The only conclusion that Dr. Harris has been able to reach is that at the time the patient first appears there was some irritation from the retained toothpick which caused a reaction and set up a certain amount of adventitious tissue, and this curtain increased in the wall between the upper end of the oesophagus and the end of the trachea. The case was one of the most perplexing that he has ever treated, and he has never heard of a similar one. The man has now been well for two months.

Empyema of the Frontal Sinus Treated by the Open Method Without Entering the Nasal Chamber. By T. J. HARRIS, M. D.

This patient was an illustration and confirmation of the opinion held by most that it is unfair to link together so closely the frontal sinus operation and the Killian operation. The man presented himself last fall with a fistula the size of a silver dollar, with a clear specific history, and a large amount of purulent discharge. He said that it had been operated upon at Roosevelt hospital without success for a time. There was no pus seen in the nose. He was put upon anti-specific treatment, and later operated upon by the open method, all of the anterior wall being removed. The wound was kept packed until it healed. There was no attempt to make drainage into the nose, and there had been no discharge into the

nose following the operation. The case was operated upon two months ago and has been healed for four weeks. Not even the floor of the frontal sinus was removed.

The scar tissue was present before the operation.

Case of Atrophic Rhinitis—Dependent on Ethmoiditis, with External Operation on the Ethmoid. By T. J. HARRIS, M. D.

Dr. Harris said that he thought this case would be interesting in connection with the others. This young woman who presented herself some months ago was a most pronounced case of ozaena. It is claimed that we do not now see so many of these cases as used to be seen, but this case compared very well with the old timers. Nothing seemed to relieve the discharge. An attempt was made to cure it by an inter-nasal operation, but it had no effect on the discharge. So warning her of the possible disfigurement, an external operation on the right side such as Dr. Coffin advocates, was performed, the anterior cells being thoroughly exenterated. Since then there has been a very marked cessation of the discharge on this side. An interesting point to those who are doing the Killian operation is that Dr. Harris succeeded in sewing the naasl mucous membrane together after finishing with the intranasal work, and it made a happy healing. Killian has given this up, but in this instance it seemed that as long as there was a good curtain there it would help matters along. There was very little scarring.

DR. HARRIS said that he would also like to make a report on the case in which he had made a tentative diagnosis of Gumma of the Larynx at a previous meeting. There has been a progressive improvement during the past month, and the patient's voice is almost restored to normal. There is now only one little point to be seen on the left vocal cord.

Two Cases with Unusual Hyperplastic Soft Growths of the Septum Nasi. By R. C. MYLES, M. D.

Case I, was a young lady from the South who had large venous angiomas on both sides of her neck, posterior to the median part of the sterno-cleido mastoid muscle. There was also a venous angioma on her wrist. The angiomas on the neck had been cured with injections of boiling water by Dr. John A. Wyeth. On either side of her nasal septum there was a tumefied mass representing the tubercle of the septum. The tumor on the right side was about 1 1-4 inches long by 3-4 of an inch transversely, pressed upon the outer nasal wall, and obscured the middle turbinal body in a

rather open naris. At first Dr. Myles was inclined to remove the masses with the snare, but remembering the history of the angiomas, and on account of a moderate bleeding which continued for over a week, caused by manipulations, with a probe; operative procedure was deferred, and she was called away from the city before an attempt could be made to remove the tumor with hot water, and before Dr. Myles had an opportunity to present her before the Section.

Case II, was a man who was presented in the scope room and who had suffered for many years from an extensive papillary hypertrophy of the inferior turbinals along the middle and posterior portions: on the left side of the lower posterior part of the septum there is a mass of semi-papillary tissue, which is rather peculiar as to situation and appearance.

DR. SMITH said that he had seen some of these growths upon the septum nasi, but had never seen one just like that shown by Dr. Myles to-night, springing so close to the floor of the nose. Those he had seen were higher up. Some of these soft tumors yield to potassium iodide and are usually thick and boggy.

Total Occlusion of the Posterior Nares. By WOLFF FREUDENTHAL, M. D.

The sister of this patient applied for treatment six months ago, suffering from ulceration of one tonsil. There was no lues, and no tuberculosis, and the ulceration healed in a few months.

Three months ago this patient, aet 25, came in complaining that she could not breathe very well. Examination revealed large masses of adenoids which were removed by her family physician. She breathed better for a while, but later lost control of the muscles of the pharynx and could not breathe even as well as she had done before. Six or eight weeks after the removal of the adenoids Dr. Freudenthal again saw her and to his surprise found that almost the whole of the soft palate was adherant to the posterior wall. Nasal respiration is very poor and the hearing is already affected. Every one has seen such cases, but the question is what is the etilogical factor here? Are the two sisters suffering from the same cause, hereditary lues, or not?

The blood of both patients was examined, and the Wasserman test made in both cases six times, all of which were negative. In spite of this, Dr. Freudenthal is inclined to believe that it is a case of hereditary lues, for the case cannot be explained in any other way, although there are no other confirmatory signs. The woman

naturally thought, as most would do under the circumstances, that the physician who removed the adenoids had done some harm, but he was a man who had had some experience, and the operation of removing adenoids is not so difficult that such serious damages are likely to occur.

Dr. Harris said that he had been much interested in Dr. Freudenthal's case. He had never seen just such a one, but he recalled a case in the French literature reported a year or two ago, where a specialist reported a case in his own practice of total occlusion of the naso-pharynx. In this case the cause was very clear. He learned that some country practitioner had attempted to remove the adenoid tissue and had stripped off the mucosa from the posterior pharyngeal wall. Later the patient had a double otorrhoea. There was an operation on both mastoids, and still later for an occlusion. When the pharynx was opened up it was found to be full of the adenoid growths which had not been detached in the course of the primary operation.

In reply to a query from Dr. Myles as to whether this applied to the cause or the treatment, Dr. Harris said that it applied to the cause or the result.

Dr. Voislawsky said that two years ago he saw a case following the removal of adenoids in which the opening was as large as a lead pencil. The patient was a young girl of sixteen. Both sides were slit down where the adhesions were, and in a week there were adhesions again. These were again cut down, one side at a time a piece of rubber tubing was inserted. The same thing was done on the other side later, and now the young girl articulates plainly.

Dr. Johnson said that it seemed very doubtful whether or not these cases were produced by the operative procedure. A year and a half ago he saw a very extensive pharyngeal ulceration which had lasted for several months in a girl thirteen years old. At first he thought it was tubercular, but finally concluded that it was specific. The whole pharynx seemed to be involved, and the child could scarcely get any air through the nose. This patient has had no operative treatment, but there was simply ulceration of the posterior pharynx and pillars of the fauces with subsequent adhesion. It may be possible that an attempt to remove an adenoid might prove an exciting cause to inflammation and ulceration but it hardly seems fair to generally charge these conditions to the adenoid operation.

DR. FREUDENTHAL said that the case referred to by Dr. Harris was very interesting, but as he knows the physician who performed the operation for adenoids he was inclined to agree with Dr. Johnson. The Doctor is an ophthalmologist and has been working for a year or so in that line, and ought to be able to remove adenoids. He said that he removed them with a curette, and it is hard to understand how the whole palate could be stripped of its mucous membrane; but as happens often in cases of old syphilis after any operation, it is probable that the latent syphilitic virus was made active and ulcerations sprang up. That seems to be what has occurred with this girl.

Cystic Accessory Thyroid Gland at the Base of the Tongue. By T. W. CORWIN, M. D.

This patient, W. G., aged 15, and much below normal stature, came to my clinic at St. Michael's Hospital, Newark, N. J., in November, 1908. He presented two tumors.

One was found in the thyro-hyoid region of the neck was the size of a chestnut, certainly not less than an inch in diameter, and the other covered the base of the tongue from side to side and reached antero-posteriorly from the circumvallati papillae to the glosso epiglottic ligament. It was a firm cyst-like mass about an inch in vertical diameter and reached up against the velum. Attempts at speech were very much impeded. This was the only complaint. He could swallow comfortably, and took ordinary food. The growth was firm on palpation, but had a cystic feel. It was bluish gray in color, and traversed by large veins springing from the base and running vertically on all sides. Pressure upon it caused no swellings elsewhere. An anaesthetic was given and the thyro-hyoid tumor was removed. The tumor at the base of the tongue was tapped at the same time, after which it shrank to one-third the original size. Free hemorrhage occurred and had to be controlled, but there was no other trouble, although the healing took a little time. The tumor in the neck was examined microscopically, and a diagnosis of accessory thyroid gland was made. It was said to be a clear case with no doubt of the character. The patient got into comfortable health. Two weeks ago a small slice was removed from the anterior part of the tumor on the base of the tongue for examination, and the same diagnosis was made—that it had the characteristic thyroid tissue. Dr. Corwin said that he had referred to the case at the last meeting of the Section,

and thought the members would be interested to see the patient. He had seen but one other like it.

DR. FREUDENTHAL said that it was exactly like a case which he had presented before the Section a few months previously. That patient has since disappeared.

DR. SMYTH said that it was very rare to see these conditions in men. There are more cases than are generally recognized but it is unusual to see them in males, and particularly in so young a boy as this patient.

New Operation for the Relief of Obstruction of the Anterior Nares.

By J. E. MACKENTY, M. D.

DR. JOHN EDMUND MACKENTY: Feeling the need of some better surgical procedure for the relief of obstruction of the anterior nares, I devised last year the operation here detailed.

It is intended to relieve obstruction arising from the following causes: Collapse of the ala-nasi. Congenital occlusion due either to abnormal smallness of the opening or to a high placement of the anterior nasal floor. Acquired high placement of the anterior nasal floor caused by narrowing of the dental arch and raising of the hard palate during the plastic period in the growth of the cranial bones.

The operation aims to lower and widen the anterior nares, thus allowing the air to enter the nose at a lower level. An incision beginning well up on the septal side, is curved downward, following the margin of the nostril across the floor and up on the ala for a short distance. With scissors and knife a flap is raised extending back on the septum and floor beyond the ridge of bone. This ridge of bone is cut away with chisels and forceps until the floor of the nostril lies on a level with the floor of the meatus behind. Then from the septal side is removed as much of the tissue as can be spared without endangering the support of the nasal tip. All the redundant soft tissue is cut away from the flap and the parts lying in the vicinity of the ala.

When the flap is now brought down, we find that it lies from an eighth to a sixth of an inch above the newly made floor. To bring the flap down, it is cut backward well up on the septal side, the object being to leave the uncovered area which must result, on the septum and not on the floor. This places the area of cicatricial contraction where it can do no harm. Three stitches unite the severed edges of the skin. To better coapt the parts, a splint, made from dental rubber to fit each case, is worn for a week.

Up to the present time, eight cases have been treated by this method. The result in all was a complete relief of the obstruction. Five of them had collapse of the ala-nasi, one had fracture of the superior maxilla in which the line of fracture entered on and occluded the nostril of one side. Two were in children with high, narrow dental arches, and a high placement of the floor of the nostril.

DR. COCKS said that Dr. MacKenty's operation meets a long felt want, and congratulated him upon his achievement. He had had opportunity to examine beforehand the case shown to-night, as well as to follow the various steps of the operation, which is easily and quickly performed.

Edema of the Tonsil and Pharynx, Condition Two Years after Dawharn's Operation for what was Considered at the Time to be Inoperable Epithelioma. By HARMON SMITH, M. D.

The patient is fifty-three years of age; no specific history; no cachexia; no glandular involvement. The old scars can be seen on the side of the neck where the carotids were extirpated. The growth has grown very slowly since that time. There is some pain occasionally, and some bleeding, but he complains more of the pain outside the cheek than in his mouth. Dr. Brewer will give the previous history of the case. The following is Dr. Wright's report from a section taken from two different locations upon the tumor.

"The sections from this growth—while exhibiting in the surface epithelial layers and in the stroma just beneath it appearances associated with the structure of flat-celled epithelioma or cancroid—show that the bulk of it is made up of cells closely resembling in places the basal layer of the epithelium with which at these points they seem to be connected. Throughout the rest of the area of these kind of cells, the atypical type chiefly resembles that of the endothelium of the lymph spaces and of the mono-nuclear lymphocytes. While some histologists would doubtless class this growth among the basal-celled epitheliomata of Krompecher, I think the majority would regard it as essentially an endothelioma. As for my own interpretation, the expression of it would carry me beyond the limits of space allowable for a communication to be used in the clinical report of the case, and will be left for another report."

DR. BREWER said that the patient was admitted to his service at the Roosevelt Hospital during the summer, four years ago, and was under the care of the Junior Surgeon. He did not recall

having himself seen the man until he came to the Manhattan Hospital the other day; but the history shows that he was admitted to the hospital and this growth was located on the soft palate, having all the appearance of a rapidly growing epithelioma. It was so large that it seemed unwise to do anything but the simple palliative treatment by the starvation method, as recommended by Dr. Dawbarn. It seemed to be an inoperable epithelioma of the palate involving the tonsillar region. A piece was removed for microscopical examination, and it was reported to be epithelioma. When Dr. Brewer saw the patient the other day, it occurred to him that any of the ordinary forms of epithelioma found in the mouth or buccal cavity would certainly long before this have gone on to glandular metastases and cachexia. He has seen them continue on the face, but these come from the small cells and are not like the ordinary pavement celled epithelioma and malignant forms—they produce no metastases or cachexia,—they are essentially benign, although they cause great destruction of tissue. He has never seen this latter condition on the mucous membrane of the mouth.

The operation performed was the complete extirpation of the carotids (both) as suggested by Dr. Dawbarn. All are familiar with his work, and certainly in this instance the growth has been arrested. In another case shown before the Section some three or four years ago, an extensive carcinoma of the larynx shrunk to half its former size within three or four weeks after the operation. After three or four months of relief, however, it went on to glandular and other metastases. This man has gone on for four years without evidence of glandular involvement or cachexia. He had suggested that it seemed to resemble more the endotheliomata which occur around the pharynx, resulting probably from misplaced masses of salivary gland tissue, and found surrounding the tongue. A number of them are practically innocent and remain so for years, and although the growth is gradual they show no signs of metastases, but sooner or later they may develop malignancy. Bland Sutton describes two types—one innocent, and the other endothelioma. They are of mesoblastic origin and have certain amounts of fibrous tissue. They are apt to have cartilage, and are apt to have a large mass of glandular tissue. It seems that although this growth is enormous and involves the palate, tonsil, upper and lower jaw, it may be a comparatively innocent tumor, and if it can be removed it will relieve the patient greatly. It is constantly growing, and is now giving him pain. Its removal would probably necessi-

tate the loss of half of the upper jaw, yet as the patient has gone all this time without presenting metastases operation ought to be considered. It seems probable that the earlier diagnosis was a mistake, and the present diagnosis of Dr. Wright corresponds so closely with the history of the endotheliomata of the palate that there is little question in regard to it.

DR. SMITH said that Dr. Brewer would probably report on the case later, as the patient would be returned to him that he might exercise his own judgment as to the advisability of operating.

DR. MCCOY said that in all his experience he had seen only one case of endothelioma of the mouth which had exactly the same location as this. He concluded that it was a rare condition and one that is extremely interesting. The one he had seen was interesting in that it was thought to be a peritonsillar abscess. He was a young man of thirty, who said that he had been bothered with his mouth and throat for a week. On examination it was found that he had an ulcerated tooth, and the redness spread over this tumor-like mass above his tonsil. Dr. McCoy immediately thought that it was a case of peri-tonsillitis, and proceeded to incise it, and encountered something very hard. He had seen nothing like it before and took a section, which was reported to be endothelioma. The patient disappeared from view and he saw nothing more of him, but hoped that he had fallen into the hands of some of the members of the Section. An interesting point was that he said the growth had been there for only a week, whereas from its size it must have been there for several months. He only noticed it when his tooth began to bother him.

Closed Empyema of Ethmoid and Frontal Sinus with Unusual Symptoms; X-Ray Plates; Killian Operation. By JOHN MCCOY, M. D.

The patient, a young girl of sixteen, applied for treatment two months ago, with a history that four years previously she had noticed a commencing obstruction in the right nostril which grew worse until August of last year (1908), when she commenced to have very severe headaches. These persisted up to the time she came under Dr. McCoy's observation, and she had little relief from them. Not much had been done in the way of treatment; she had some spraying, and some internal medicine, but nothing radical. Examination revealed considerable oedema, and nothing could be seen in the nose except the anterior border of inferior turbinate. The septum was pushed to one side and it seemed as if there was a growth which was displacing the septum, the eye, and the facial

bones. Under cocaine he explored in the nose and went into an apparently closed empyaema. The X-ray plate showed that the orbital plate of the ethmoid is twice as far from the middle line on the diseased side as on the other, the septum was pushed well to one side, and the bones of the face pushed out. Radical operation was advised and was performed on the 1st of February. The wound has now completely healed, but there is a deformity which will always exist. The nasal processes of the superior maxilla and of the frontal bone are pushed out and will probably remain so.

Chronic Suppuration of Frontal Ethmoid and Sphenoid Sinuses in Right and Left Nares; Radical Operation. Both Sides. By JOHN MCCOY, M. D.

The patient, a woman, age thirty-six, had a double case of suppuration of the frontal, ethmoid, and sphenoid sinuses. She was first seen a month and a half ago, and had been suffering intensely from headaches on both sides of her head for a year and a half. She applied for treatment on account of swelling underneath and around both eyes. The swelling would balloon out and remain for three or four days, and then subside. On examination there was found considerable pus in the ethmoid, and X-ray pictures showed involvement of frontal and ethmoid on both sides. There was also an old specific scar in throat. She was placed on mixed treatment and intranasal treatment for one and one-half months; but finally the swelling under R. eye resulted in an abscess. On probing, the orbital plate of the ethmoid was penetrated, and it seemed best to do a radical operation on both sides. The complete Killian operation was done on the right side. In doing the operation and laying the eye aside, a probe was readily passed from the external sinus into the opening in orbital plate of ethmoid. There was also an area of necrosis in the orbital plate, on the L. side the external operation for ethmoid was done. The operation was done two weeks ago, and the wound is healing kindly.

The Orbital Route to the Accessory Sinuses. By PERCY FRIDENBERG, M. D.

To be published in full in a subsequent issue of THE LARYNGOSCOPE.

Observations on Some Unusual Cases by Frontal Sinusitis By L. M. HURD, M. D.

To be published in full in a subsequent issue of THE LARYNGOSCOPE.

DR. CARTER said that he also wished to express his appreciation for the manner in which Dr. Fridenberg had presented the subject.

He regarded it as very important that the relationship of these cells with the surrounding important structures should be thoroughly understood and appreciated by the surgeon. In considering the orbital route to the ethmoid cells and the sphenoid as advised by Dr. Fridenberg, he thought that several objections might be raised. These, however, obtained in cases where the infection had not already extended into the orbit. When this had occurred the orbital route might have some advantages, but when a new area is opened up, in addition to the necessary scarring, we must consider the possibility of orbital cellulitis, thrombo-phlebitis and optic neuritis, for he questioned the efficiency of the peri-orbital tissues in protecting the orbital contents from infection. The question of emphysema and of subsequent disturbance of ocular equilibrium must also be considered.

Dr. Carter said that he agreed with Dr. Fridenberg that one can get at the ethmoid cells and sphenoid more easily by this route but he questioned whether it can be done more safely. Personally he prefers the nasal route, or the Caldwell-Luc operation when the antrum is involved.

Dr. Myles said that it was difficult to discuss such a subject briefly. Dr. Fridenberg's paper was excellent and presented much valuable information, but if a series of consecutive cases were reported, it would be shown that the internal operation was as important as the external one in properly selected cases. In the cases of protruding fistulae or cystic conditions in the orbital cavity or in the region of the upper inner canthus, he had usually found but little necrotic tissue, and that these cases were usually cured by making large openings into the nasal fossa, either by the internal or the external operative procedure. He could see no reason why, when the diseased condition was confined to bulla ethmoidalis or the group of middle ethmoidal cells, that attempts should not be made to cure it by removing intranasally the middle turbinal and the floors of the cells. He was opposed to curettage of the upper and posterior walls of the sphenoidal cells, and the outer lateral walls of the posterior ethmoidal cells. He believed in large permanent openings in the floors of the ethmoidal cells, and the anterior wall of the sphenoid. He is a firm advocate of the external ethmoidal operation in properly selected cases. In the case referred to by Dr. Hurd, he had advocated a complete Killian in an acute case on account of certain desperate conditions, which operation Dr. Hurd had performed successfully, although he believed

that Dr. Killian did not endorse complete radical procedure in acutely infected sinuses.

Referring to the cases reported by Dr. Hurd, he had observed that the pains occurred in the mornings and ceased in the afternoons. He believed that the time of the pain was regulated by gravity and the upright position of the patient after the recumbent one of the night. The thick mucus gravitates to the strictured naso- forntal ducts and is forced through by the gas and fluids above.

The chief objection he has to the internal operation is that in cases where the pain has been relieved and the serious symptoms of necrotic canges continue, the patients defer indefinitely their consent to the necessary radical external operative procedurs.

He also reported a case of an extensive post-orbital abscess following a radical frontal sinus operation which temporarily caused blindness until the abscess was incised and drained.

Dr. McCoy said that he agreed with all that Dr. Fridenberg had said, regarding removal of orbital plate of ethmoid, for one can see very much better into the field of operation. While he agreed with Dr. Myles as to the necessity for the radical operation not occurring so very often, he was in favor of taking down the orbital walk, for he has found that when the thin plate is left in it is difficult to get healthy granulations to grow form it; they are apt to be polypoid in character and to persist for a long time. For the last few years he has taken down the thin orbital plate, and has had much quicker healing than before.

In the next place, in regard to hemorrhage. We get the greatest hemorrhage in the diseased tissue. As soon as the inner plate or the healthy bone is reached the hemorrage stops in the great majority of cases; and in most cases by the external method we are less bothered by the hemorrhage, for we appreciate where the boundaries are and can more easily control the hemorrhage.

The cases reported by Dr. Hurd were very interesting, especially those in which the patients complained of vertigo. Personally, he has never seen a case of frontal sinus with vertigo, and he could not but wonder how much the element of neurasthenia enters into such cases.

Dr. Geo. E. Davis said that the vertigo might come from some disturbance of the labyrinth.

Dr. Smith said that he would like to say a few words in regard to the orbital entrance. He had had a number of cases referred

to him, from the eye department, where there was orbital cellulitis, and occasionally orbital abscess. In these cases he has gone in primarily through the nose by preference, with the understanding that if this did not relieve the condition he would later go in externally, for by taking off the turbinate and relieving the pressure from behind the condition has been relieved. The patient should have the benefit of the doubt. Entering the sphenoid externally you cannot perceive a nerve that is out of its regular course very easily; there is too much uncontrollable bleeding. Adrenalin has but little influence, and other styptics have less. In no instance has he been able to see sufficiently well to determine the presence of a nerve that has been misplacd, and it harly seems possible to do so. There is just as much danger of disturbing a misplaced nerve by going in externally as by going through the antrum or through the nose.

Dr. Fridenberg said that Dr. McCoy had answered one or two of the objections raised by previous speakers. He would hardly venture to oppose Dr. Myles' wide experience by one or two observations from literature. To a certain extent, however, he agreed with him that many cases of accessory sinus disease are amenable to intranasal treatment. This applied particularly to cases in which removal of the middle turbinate, of polypoid hypertrophies, and opening up of swollen ostia was immediately followed by profuse discharge of pent-up secretions and consequent free drainage of the accessory cavities.

Infection of the orbit in the orbital operation is almost unknown. As to the orbital infections, this is by diseased bone in most cases, and the manner of prevention is to remove all diseased bone as far as can be seen, and establish a free area of drainage—and free drainage by the orbital operation is much greater than by any intranasal procedure. That is the greatest possible protection against infection. The peri-orbita is by no means thin, and it is fairly tough. An abscess may persist for a long time without penetrating into the soft tissues, and such penetration is not a common complication; after the area has been thoorughly cleaned out there is not much danger of infection. The same holds good in regard to orbital emphysema; in order to have that, there must be a perforation of the orbit, and that can not take place under the ordinary operation unless the peri-orbita has been torn, and even then it is an infrequent occurrence.

Conclusions: The orbital operation for radical cure of accessory sinus suppuration is absolutely indicated in cases of manifest orbital

complications, such as fistula, subperiosteal abscess, mucocele causing exophthalmus, or evident dilatation of a cavity into the space surrounding the globe; in intra-cranial complications which indicate a focus of infection in the accessory cavities, in the presence of serious symptoms—in which intranasal procedures are not followed by a prompt and decided improvement.

DR. HURD said that in starting the operation he takes down and lifts up the orbital periosteum from the bony lachrymal canal right through the pulley to the supra oblique as far internally as necessary and back to the anterior ethmoidal vessels, and then takes down the anterior frontal sinus wall. While the hemorrhage is causing about orbit then the bony orbital wall that forms part of the walls of the frontal and ethmoidal sinus are removed. This not only gives greater access to the posterior ethmoid and the sphenoid, but the external walls of the ethmoid can be taken down at the same time. The operator knows where he is and there is a much cleaner wound all around. In the boy that he operated on last winter he found that all the orbital wall had been replaced by perfectly smooth hard bone, like ivory.

PRESENTATION OF INSTRUMENTS.

Presentation of a Combination Snare for Intranasal and Tonsillar Work. By J. H. ABRAHAM, M. D.

The instrument is not too heavy for use in the nose and is yet strong enough for any tonsil. The particular instrument presented had been used in over twenty-five cases and had proved very satisfactory.

The Importance of the Microphone in Examining the Auditory Functions. G. FERRERI (Rome). *Archivio Italiano Otor.-Laring.*, No. 1, 1909.

After briefly referring to the importance of examining the functions of hearing in cases of accident or of simulation, and especially in school children, the author mentions several instruments which can be used for these investigations and recommends principally the use of the microphone. To prove the importance of such an instrument the author describes several cases in which the microphone has served to detect deficiences in hearing that could not have been detected with other means of investigation.

LASAGNA.